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EDITORIAL NOTES.

Calorific Value, and an Important Experiment.

THE Eastern Counties Gas Managers' Association are to be warmly congratulated on their accomplishment in having prevailed upon Mr. T. Goulden, the Chief Engineer of the Gaslight and Coke Company, to take their Presidential Chair. The new President is of such a retiring disposition, and he is so immersed in his responsible duties for the great Company whose engineering and manufacturing methods and problems are under his control, that, to have succeeded in bringing him out through their chief office into the broad daylight is an achievement of which the Association may be proud, and the members may look upon it as making quite a red-letter day of their fiftieth semi-annual meeting. But it is not of Mr. Goulden personally that we wish to speak, good as the personal subject may be; his views at the present stage of our industrial affairs are, we say with all deference, of more general importance, seeing that they are founded on such a large experience, and drawn from such a broad outlook.

In his address, Mr. Goulden casts his eye over the position of the industry; and he tells us what he sees. This leads up to what we regard as the very kernel of his utterances, which kernel we venture to think will have somewhat powerful influence in hastening the rate of conversion of the industry from the standard of illuminating power to that of calorific value. Prefacing this point, the President, as intimated, considers the conditions of the gas industry, and its patent work in serving the community. His scrutiny leaves in his mind no doubt whatever that there is a larger future for the industry than we have ever attempted to picture; and there are all the indications in the industry itself that it is ripe, and working correctly, for entering into greatly extended possession of its rightful place in the world's affairs. There is more life than ever in the industry. Many of those in responsible charge of gas undertakings have had their eyes opened; those who have not are gradually awakening from their lethargic state by the movement around them. The manufacturers of the gas industry's appliances are keener than ever in promoting utility and efficiency. To what is all this largely due—organization. Organization through which money is being spent, and the value of which money (we say deliberately) is being returned to the industry many fold, not only in direct commercial result, but through the new life which has been generated in the industry itself, and which has produced, and is still producing, a quickening of its very blood. This alone is a good return. Public interest and public inquiry have likewise been aroused. The seed is germinating, and new business is opening up here, there, and everywhere. The very organization that is making its influence felt among the public, to the mutual advantage of the public and the industry, has been the chief promoting cause of this new life, by bringing into co-operative relation the administrators and officers of the supply industry and the manufacturers of its appliances. It has been, and is, an educational force among them all. On the one hand, more is becoming generally known of the needs of the public; and, on the other hand, the friendly rivalry of the manufacturers is being stimulated by the desire to excel in the characteristics of their own goods, and to gain, through efficiency, the favour of those who are in closer touch with the public than they are themselves. It is due to the manufacturers that success should be acknowledged by the patronage of gas undertakings, and personal friendships should not be the dominating factor. The future, the President agrees, has no limitations for the industry; but may we add the proviso, if its life is maintained at the pitch that animates it now. With the considerations before us prompted by the address, our confidence is great in saying that we cannot estimate the value that the British Commercial Gas Association has been to the industry, quite apart from the work of organization among the public.

The industry has put its hand to the plough; and there are two things that Mr. Goulden says it must do—one is to continue to educate the public; the other is to work in providing cheaper gas. We add a third. It is to maintain and extend, by the means that have already proved effectual, the life that now exists in the industry. The provision of cheaper gas is important; and this is a matter that the President has been looking into very seriously. As a result, he brings forward a point that is pregnant with great possibility. He has been experimenting to ascertain the maximum quantity of gas of good composition (see the analysis in the address) that he can obtain from a first-class Durham coal, carbonized in horizontal retorts of normal section. Carefully weigh this: The best result was a production per ton of coal of 15,840 cubic feet of gas of 530 B.Th.U. gross; the illuminating power being 12·15 candles. Illuminating power being practically of no importance to-day, these figures are very significant. Per ton of coal, they represent a total in heat units of 8,395,000, compared with 7,300,000 with a make of 12,000 feet of gas per ton, or about 600 B.Th.U. per cubic foot. That is to say, by increasing the make of gas by 3840 cubic feet, an additional 1,095,000 B.Th.U. were obtained in the shape of gas per ton of coal, or an increase in B.Th.U. of upwards of 12½ per cent. We are in search of further economies for the benefit of the industry and its customers; and the figures point unerringly to the suppression as early as possible of the illuminating power standard, and the substitution of the calorific value one. We cannot ignore the number of B.Th.U. put into the gasholders per ton of coal carbonized; for it needs no argument to point out that, if 8,395,000 B.Th.U. can be obtained from a ton of coal such as Mr. Goulden used in his experiments, as compared with 7,300,000 B.Th.U., the gas industry can afford to give to the consumers more in the way of thermal value for a given price. Therein is economy—providing always that the residuals are not depreciated in a manner that will cause a countervailing revenue recession in that direction. We have not the slightest doubt that Mr. Goulden has taken this aspect of the matter fully into consideration; seeing that he regards his finding as of considerable importance, in view of the fact that it is for heat units rather than illuminating power that the manufacture of gas will in the not distant future have to be conducted. In short, until the change is made from the one standard to the other, "we shall," remarks the President, "be con-
" siderably hampered in the further progress of manufacture
" which my experiments indicate to me as being possible,
" inasmuch as the maximum production of gas measured
" in volume of heat units is accompanied by such a reduc-
" tion of illuminating power as is not permissible under our
" existing statutory obligations."

Mr. Goulden's experiments and pronouncements in this connection cannot be too highly valued; for he is not the man to bring forward publicly a matter of this kind without full consideration. His Company are at the moment under a dual standard; and there is feeling engendered by experience underlying his words: "I need not assure you that the
" engineering ranks of my Company will welcome the day
" that brings with it the disappearance of the necessity for
" further consideration of the illuminating power standard."
After what Sir Corbet Woodall has lately said, we shall not be surprised if this happy release from the bondage of illuminating power is near at hand; nor shall we be surprised to find the year of Mr. Edward Allen's presidency of the Institution of Gas Engineers marked by the conversion of the standard of another important Company. Gas undertakings that are in Parliament this year, and that adopt calorific value as their standard, will find themselves in excellent company; and, in the Presidential Address of Mr. Goulden, they have excellent argument—if argument were needed after the precedents already created—that must

have weight in laying before Parliament the case in regard to expediency and economy of the change in the interests of the consumers of gas, who enjoy such a considerable proportion of the proceeds of gas-manufacturing advances.

At the Ideal Home Exhibition.

THE Ideal Home Exhibition has become quite an annual social event in the Metropolis; and it is one of the most popular sight-seeing fixtures that has ever been instituted in the category of exhibitions. The very suggestion of an ideal home attracts; and the man was a true inventor who conceived an exhibition under this designation. There is no question about the number of people who visit the display at Olympia; the public Press circulating all over the country also takes it up; and it is written about and talked about—not only written about in the public Press, but in the professional and trade papers, especially those devoted to architectural and furnishing work. If gas were not represented there, it would, as suggested in a descriptive article in other columns, be little short of a calamity; and for two reasons—the foremost being that it would suggest that gas has no claim to lot or part in the making of the ideal home (in adding to its comfort and conveniences); the second being that, owing to the circumstances under which the contract for the lighting of Olympia is electrically held, unless gas could be brought into use through exhibits that require gas for their demonstration, the doors of Olympia, in this genuine advertisement of the latest contributions to perfecting the home, would be tightly closed against the primary commodity of the gas industry.

Through the enterprise of the South Metropolitan Gas Company, a splendid demonstration of what gas is able to do was made last year in an attractive setting, and at large expense, which was borne entirely by them. This year, as the article elsewhere shows, the Company have excelled their previous performance; and their demonstration is of an order that, within the past few days, has evoked praise from all who have seen it. Representatives of the chief of commercial competitors, who have been looking upon the Ideal Home Exhibition as one of their strongholds, stop and do not veil their admiration; and from the utilitarian standpoint, there has been no hesitation in some cases in admitting that what the South Metropolitan Company have done, and have done so well, belittles the much advertised La Maison Electrique, which looks mild and unconvincing in comparison. The gas exhibit is of four-fold character. It shows typically the beautiful works of art that the manufacturers of gas-fittings have produced; it supplements this with object-lessons; it also illustrates the efficiency of gas as a saver of labour and producer of household convenience and efficiency; and it goes farther, and brings demonstratively before the public eye the economy and efficiency of coke as a domestic agent.

It is a fine display, and is altogether good; and the gas industry are again the debtors of the Chairman and Directors of the South Metropolitan Gas Company. But we cannot help saying this: All associated with the gas industry who visit the Ideal Home Exhibition admit that the absence from it of such a gas demonstration would be nothing but a lamentable thing; and it is distinctly our feeling that the cost of such a display ought not to fall upon a single Company. The Electric Light Companies of the Metropolis, through the Electricity Publicity Committee, have amalgamated in producing La Maison Electrique at the show this year; and this serves as a hint of what we think should be done in regard to a gas demonstration on future occasions, through (say) the British Commercial Gas Association. This year there is the National Gas Exhibition in London. Even so, it would have been (we say it very emphatically) a misfortune had there been no gas representation in the Ideal Home Exhibition. Recognizing the work of the South Metropolitan Company this and last year, it may be submitted as a suggestion that it ought not to be left to that Company year after year to bear the expense single-handed of such a demonstration. Part of the gas industry's work—and an important part—lies in the particular lighting field where custom has been lost; and it is there (there is nothing to be gained by blinking the matter) where the greatest resistance has to be offered, and work done in the effort to regain a lost lucrative field. The gas industry is advancing by leaps and bounds in other directions; and fresh applications are constantly coming along for development. But we cannot, and must not, neglect what has been taken from us, nor the particular field in which it has been lost; for it is in this direction that business competitors are at work most assiduously. Bearing this in mind, it ought to be seen what can be done to lift what must be a heavy burden from the shoulders of a single Company in making a demonstration under favourable and ideal conditions. Without any prompting whatever from the Company, we do feel this; and it is to be hoped that the suggestion will be taken, both by the Company and others, in the spirit in which it is made.

The Residuals Restriction.

THERE are to-day in the United Kingdom about twenty-five gas undertakings which are, as a consequence of the fight made by the chemical manufacturers in 1912, under complete restriction as to dealings in residuals being confined to their own production. They have no liberty to go outside the restriction, no matter how much it may be in their own interests, or in those of neighbouring gas undertakings, that they should have the entire freedom that the Joint Committee of both Houses of Parliament said, in effect, ought, in the common interests, to be enjoyed by the whole of the gas undertakings in the United Kingdom. The restriction may not be an irksome one for an undertaking to-day; but it may be so to-morrow. More important still, however, is the question of principle; and on the question of the principle of restriction in regard to residuals dealings, the Joint Committee spoke in no uncertain voice. It is time therefore that the question of wiping-out the disability which was placed upon the twenty-five gas supply concerns was seriously taken up; for it is not wise to allow any such disuniformity of principle in gas legislation to exist any longer. Such a matter, affecting as it does a principle in gas legislation, it appears to us, is essentially one in which the Gas Companies' Protection Association should take the rectifying initiative. Under the auspices of the Association, a movement with the view of repairing the mischief done in 1912 was made last year; and our columns remind us that, on Jan. 9, a meeting was held at which a resolution was passed authorizing the Parliamentary Agents (Messrs. R. W. Cooper and Sons) to confer with the Parliamentary Authorities regarding the promotion of a "late" Bill, with a view to repealing the restriction in the case of those Companies who were prepared to link themselves together in the promotion of such a Bill. There was, in accordance with the resolution, a conference with the Private Bill Authorities; and we believe that eventually the Lord Chairman decided that there was no pressing necessity for a "late" Bill. Now we come to the time when a Joint Bill could be promoted in the ordinary course for repealing the restriction, and so re-establish the rights of the gas undertakings concerned in the matter of residuals dealings. It appears to us that it is dangerous on the part of those undertakings to procrastinate in seeking to obtain relief. Therefore, we hope to hear of an early movement being made. It would probably help things forward if the interested gas undertakings would communicate at once with the Secretary of the Gas Companies' Protection Association, or with Messrs. R. W. Cooper and Sons, who, as Parliamentary Agents, had the question in hand last year, and dealt with the case on behalf of the gas industry in the preceding session.

Machine-Produced Industrial Problems.

IN the improvement of the world's affairs by advances of science and invention, new problems must inevitably arise which have to be dealt with through the agency of human brains and human resource. By every advance the world is bettered; and there is universal enjoyment, in some way or other, of the progress effected. Individually, some may suffer in consequence of this progress; but, to every individual who is capable of exerting himself, progress offers fresh opportunities, as well as new scope for the employment of talent that might otherwise be consigned to permanent dormancy. It is well to have these broad considerations in mind when descending into the narrower paths where examination has to be made of some of the more sombre effects of progress which demand the application of ameliorating measures where remedial ones are impossible. It is part of the true constructive policy of life to find means by which there shall be amendment of undesirable conditions that cannot, under the new order of things, be entirely removed.

Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, in an address delivered on Friday

night to the London and Southern District Junior Association, gave expression to some philosophic thoughts on various modern industrial problems which have arisen from the progress that has been made by the aid of science and invention, whereby manual labour has in particular spheres been largely suppressed by mechanical agency. He lightly sketched some of the flights that have been made from the old order of things to the new order, by which the economy of the world has been promoted; and then he turned to a consideration of the social effects that have accompanied the changes. In doing this, he confined himself largely to the effects to which it is desirable to apply ameliorating measures; and this restriction was justified by the line of his thoughts. He spoke of the contention that the change from manual work to mechanical has degenerated the man until he has come to be almost a part of the machine itself; he pointed to the allegation so frequently made that the change has operated in the direction of alienating such personal interest in work as was found in the old craftsman; he mentioned, too, the monotony of the daily mechanical round; and referred to the fact that the inroads of machinery have resulted in the annihilation of the small producer with his small capital and workshop and hand labour, and the setting up of joint capital enterprise, which has widened the gulf between employer and employee. These are some of the effects of the industrial problems that Mr. Watson suggests still require solution; and he shows how attempts are now being made to solve the more important.

We admit the existence, more or less, of the cited effects; but are certain of them really so general or so deep-rooted as certain of the more superficial sociologists would have us believe? We think not. The very evolution of things has its good effects upon men. Let us go to the machine attendant himself. Do we actually find him a less intellectual man than the man who aforetimes did the same work more slowly and less economically by manual labour? He may be the very same man. But his intellect is keener; his outlook on the world's affairs is broader; and the bodily fatigue of the old day being absent, he enjoys life the more. Ask the man whether he has degenerated into part of his machine; and he will resent any such imputation. As to the monotony of his new work, his improved personal status, through the external wider interests in which he is able to indulge, has its compensations for the change from manual to mechanical operation. Another point that has to be considered is that the volume of work in any particular line that is displaced by machinery is soon left behind by the growing requirements of the world—that is to say, the work that is done mechanically at any given time is no measure of the quantity of work displaced at the time the machine came into operation. Therefore, a large proportion of the men who have been brought into employment at the machine through growing requirements have never had experience of the manual performance of the same work. Considering this particular effect of the machine upon men, it has also to be borne in mind that the machine itself, and often the products of the machine, have brought into being new industries, which have produced a greater diversity of employment such as never obtained in the days when manual labour was more prevalent; and this has increased the opportunities and the choice of employment. Looking at these matters from the broad point of view, we are not disposed to admit that the effects upon the workers themselves are of such subversive character as some sociologists would have us credit.

The coming of the machine, however, demands from the workers quite a new order of interest—an interest that had in form no being in the days of the manual worker; and it is this new interest it is desirable to cultivate and encourage. We need not draw specific attention to the lines of this new interest; they are obvious on consideration. The other effects to which Mr. Watson refers—those which have followed the introduction of machinery through the removal of personal contact between employer and employed by industrial operations being conducted on a larger scale—we do regard as much more serious in relation to the maintenance of industrial peace and fair conditions as between employed and employer. There is a problem that is of paramount importance in these days; and if employers had all the good attributes of the ideal manager whom we find portrayed towards the end of Mr. Milne Watson's address, then the best solution yet found of this acute problem—co-partnership—would quickly be more commonly applied. The world would soon be the better for the change; and we should then hear less of those alleged minor effects of the introduction of machinery, which effects are so largely ruled-out by the widespread changes promoted by the general evolution of things.

Students and Examinations.

The Presidential Address of Mr. W. H. Johns to the Midland Junior Gas Association last Thursday may be said in effect to be of a quadruple character in respect of subject-matter; and on all four topics, he writes from personal practical experience. This being so, what he has to say in regard to them must receive consideration. Mr Johns is not only Superintendent of the Saltley Works at Birmingham, but he has devoted part of his time to educational work among students of gas engineering and gas supply. In this connection, he naturally takes a very live interest in the question of the training as well as the examination of students. There seems to be a great deal of difficulty in the matter of the shaping of a universally acceptable ideal for the training of students; and the diversity of opinions on the subject of examinations seems likely to deter the alignment necessary to secure improvement. But, while we cannot hope that all who give consideration to the subject will ultimately occupy common ground, it is only right that we should be largely guided by those who have experience in these matters, and, profiting by their experience, aim for the improvement that is recognized as essential.

We know, for instance, what Mr. Thomas Glover (an old City and Guilds Examiner) said, in his 1912 Institution paper, as to his deliberate view that the candidates for examination in gas engineering in the first grade should have previously passed an elementary science examination in chemistry and mechanical engineering; while all candidates for the final examination should have qualified by having passed the second stage in the similar science examinations. We find Mr. Johns giving Mr. Glover whole support in insisting on this preparatory stage being passed through; and, from what he says, founded on his experience, it is obvious that the suggested compulsory preliminary qualification would raise the students' efficiency, would ease and enhance the value of the gas engineering teacher's work, would save time, and would result in advantage all round. The higher standard is to be so readily attained, if the suggestion were adopted; and there would not then be the same room as now for criticism of candidates on the part of examiners. Prior to the examiner's scrutiny, the teachers who spend their time in educating the students would certainly receive a larger amount of encouragement, if there were a little more uniformity in the knowledge of the students who go to them for instruction. It is, of course, impossible to have uniformity of mental capacity and application in students; but when some students attend gas-engineering classes entirely uncultured in the essential rudiments of mechanical science and chemistry, while others are well equipped in this regard, we can understand the difficulties of teachers who want to do the best possible for each individual, and yet not allow those ignorant of elementary principles to keep back those who are qualified to apply themselves at once to the specific subject for gaining knowledge of which they are attending the classes. In the circumstances, one cannot help feeling some sympathy with the teachers and the best of the students; and we repeat that, if the suggestion of Mr. Glover, as supported by Mr. Johns, were carried through, a generally higher efficiency and a better quality of product would be the result.

There is a point with reference to "Gas-Supply" students and candidates. There appears to be a greater divergence between the qualifications and capacities of these than with the gas-engineering students and candidates for examination—though the disparity is significant in their case. Some of the men who sit for examination are gas-fitters—more credit to them; and they present themselves for examination practically trained, but without any scientific or theoretical knowledge whatever. Of course, the plans have been laid for the special examination of gas-fitters; but, nevertheless, there are men who aspire to a certified qualification above that of a gas-fitter. Such men will always be found among those whose ambitions urge them to obtain the gas-supply certificates. Mr. Johns therefore thinks there ought to be two separate examinations—a theoretical one called "Gas "Supply," and a practical and oral examination called "Gas Fitting." But there is the work that has already been done by the District Associations and the Institution of Gas Engineers to secure the better training of the gas-

fitter, and the City and Guilds authorities have insisted on a simple examination for the purpose of awarding a certificate. We see in this approximately what Mr. Johns requires in connection with the "Gas Supply" examination, except that a practical and oral examination (we should like to see it incorporated as part of the condition of certification, and the written part made as simple as possible) does not appear to appeal to the South Kensington authorities.

If men require the higher certificates in "Gas Supply," they ought to be prepared for the one form of examination applying to that, as there must be a limit to the division and subdivision of these examinations. Mr. Johns' remarks, however, suggest something else. Those on the gas-supply staff of any gas undertaking are better and more useful men if they have been through the gas-fitting department, and have had a practical training. Mr. Glover and Mr. Johns both suggest that a condition precedent to the sitting for examinations in gas engineering should be the passing of an elementary science examination in chemistry and mechanical engineering. Then why not make it a condition precedent that those who sit for the gas-supply examinations should first of all have taken the gas-fitting certificates? We see no reason why not. Some of the candidates may look upon the proposal as *infra dig.*, though it contains in it the qualification to the best service. Men of such superior notions are not required in the gas supply and sales departments of gas undertakings. The best of our gas engineers are those who have been through the shops, who have taken their place with the stokers, the purifying men, and the men engaged in every process and department that goes to make up the aggregate of work of a gas undertaking. Then why should not the men who wish to obtain certificates to help them in forming a career of service in a gas sales department, pass through the practical work of gas-fitting in precisely the same way. We have a great deal of sympathy with the views expressed by Mr. R. Halkett, in his recent North British paper, as to the proper course of training that a man should have who is aiming at a responsible position in the gas-distribution department. There must be no half measures in his training, but he must know his work from the very first principles.

In the Carbonizing Department.

It was a big leap that Mr. Johns took from the foregoing subject into the work associated with carbonization that is being carried on at the gas-works of the Birmingham Corporation Gas Department. Touching on his further subjects, we cannot help commiserating with him on the fact that novelty had been removed from what he had to say by prior publication—first regarding the coke-oven and Mond producer plants, by the paper of his chief (Mr. W. Chaney, the Engineer of the Saltley works) before the Institution of Gas Engineers, and, secondly, by what Dr. Davidson said, as to the Mond plant, and as to Brooke's patent automatic air-regulators for producers and retort-settings, when delivering the William Young Memorial Lecture before the North British Association. There is no doubt that there is scope for the attainment of much higher economy and efficiency in connection with the heating of retort-settings. No one probably would heretofore have questioned that the best that could be done was being done at Birmingham; but the fact remains that the best was not, and is not, done. The recent experience is tantamount to a confession to that effect. It has been shown by Dr. Davidson, and now by Mr. Johns, that it is practically impossible for all the variable conditions that exist in connection with the producer and the heating of a retort-setting to be compensated by the occasional adjustment of the air-slides by hand. The recognition of these variable, and in themselves quite uncontrollable, conditions is not new; any serious attempt at dealing with their effects automatically (though automatic air regulation, as the Patent Office records show, has long since been applied, or at any rate proposed for application, to furnaces in other industries) is new in gas-works, excepting perhaps in small experimental ways. Birmingham, according to Mr. Johns and Dr. Davidson, is on the high road to proving the case that, in the automatic control of the primary and secondary air supplies to retort-benches, there are to be found a greater heating efficiency and a substantial economy. If the primary and secondary air supplies can be controlled (as Birmingham says that they can be) in conformity with producer conditions and the variable pull of the chimneys, then there will be savings in fuel, there will be avoided an excessive formation of clinker, the labour pertaining thereto will be lessened, the furnace linings will have a prolonged life, and more constant temperatures will be maintained in the settings. Birmingham will later on tell us more of the pounds, shillings, and pence aspect of this matter, because Birmingham believes it has a good thing in this automatic air-regulator, about the construction and operation of which Mr. Johns in his address furnishes information which shows a large amount of ingenuity.

This brings us to a point at which there seems to be a little conflict of opinion between Dr. Davidson and Mr. Johns, which future experience will iron-out. We rather think that in Dr. Davidson's North British lecture he was hedging a little from his former opinions in regard to the adoption of Mond plant (with ammonia recovery) for the provision of gas for the heating of coke-ovens and retort-settings. The results in economy and efficiency of the Brooke method of automatically regulating the primary and secondary air supplies in ordinary settings appeared to be the cause of his partial recession from the views that he formerly held as to the Mond plant. In what he said, he was not positive; but what he did say partook of the nature of a saving clause. Mr. Johns, while full of praise and testimony to the efficiency and economy promoted by the Brooke regulators, appears to be equally enthusiastic over the Mond producers with which the Koppers coke-ovens are being heated; so much so that he believes that, in large gas-works, the heating of retort-settings may be more economically accomplished by means of Mond gas than by coke firing, with a considerable reduction of the wear and tear of the settings. He confidently believes, too, from his experience, that the application of the system will be greatly extended in gas-works in the future. There we have the uncertain position of things in relation to advance in the heating of retort-settings. The Mond system has, of course, to justify itself against the best that the ordinary system of firing retort-settings can do; and Birmingham assures us that, in connection with ordinary firing, the highest economy and efficiency cannot be realized without there is proper automatic regulation of the primary and secondary air supplies. The Mond system, with ammonia recovery, has therefore to be weighed against the latter. We shall look with interest to further enlightenment in connection with these matters, and so will many others. Since Mr. Chaney read his paper, there are engineers who, to our knowledge, have been looking very seriously into the question of Mond gas-producers, with ammonia recovery, to see whether there is in the system carbonizing economy for them. The trials at Birmingham, too, in the matter of the automatic regulation of air supplies to furnaces and settings will also direct attention to the subject of greater efficiency in the ordinary method of heating.

We cannot leave the address without referring to the portion of it dealing with the Koppers coke-ovens at the Birmingham works. In this matter, Mr. Johns also writes from personal experience; and those gas-works engineers who are interesting themselves in this question of bulk carbonization will find much valuable information in the address relating to construction, to methods of operation, and to the reasons for, and the effects from, such operation. We will leave these points, which constitute general practice where good method prevails. Ordinarily, however, the consideration of the question of the policy of gas-works adopting large carbonization units, is, of course, limited by the demand for metallurgical coke in the immediate neighbourhoods. We believe that, where there is such demand, and the area demanding a supply is some little distance from pit-head coke-oven plant, gas suppliers are the people to provide it; and for several reasons. Statutory gas undertakings will never, in our opinion, place very much reliance upon gas supply from coke-ovens that are not under their immediate charge. Their responsibilities, which are ever increasing, in maintaining the gas supply to our urban communities and industries are too great for that. What happened at the coke-ovens during the coal strike last year would have been a bad thing indeed for gas undertakings who had been relying upon a supply of gas from them. The Waste Heat Company, who are interested in the generation of electrical energy from the waste gases of blast-furnaces and coke-ovens away up North, could spin a fine tale as to their experiences in the early part of last year. For this reason, it is clear that there is a greater assurance of permanence of the supply of gas from such plant when the plant is located on the gas-works itself; and of the

permanence of the supply of metallurgical coke to manufacturers, there is also a greater assurance when the ovens are away from colliery disturbances. From being the purchasers of gas from coke-oven plant, there appears now to be a stronger prospect of gas-works in industrial areas becoming the suppliers of the metallurgical coke requirements; and, by so doing, they would be reducing the plethora of ordinary coke arising from the expansion of the demands for gas. If gas-works go on in this way supplying the requirements of industry in the matter of solid and gaseous fuel, with Mond gas production for retort heating, and, if required, for motive power purposes, with the economies of gas manufacture, and with the expansion of the lines of gas business, we may in time be able to produce economy for electricity generating-stations by supplying from gas-works their electricity requirements. Then would one part of the vision of Mr. F. D. Marshall (upon which comment was made last week) come true; then would gas-works be in truth, in many cities and towns, the sole centres of light, heat, and power. This is looking forward—perhaps a considerable distance. But who can foretell what will happen? Who can advance any reason as to why such developments should not take place?

Qualifications of a Salesman.

With the National Gas Exhibition running, the time is peculiarly appropriate for considering the matters of the work and the efficiency of gas salesmen. This extremely necessary individual was one of the subjects of the Presidential Address that Mr. S. A. Carpenter delivered to the Southern Junior Association last Friday. The qualifications and attainments of the gas salesman were partially set forth by Mr. Carpenter, who might have profitably dilated on them to a much larger extent. The proficient gas salesman is being evolved as fast as circumstances will allow; but we are quite convinced that, in many directions, some such members of commercial gas staffs will need to have their knowledge still further enlarged before they can render the maximum service to the undertaking that gives them employment. It sometimes happens that those who are in actual contiguity with matters of this kind are incapable of determining the whole of the components in qualification necessary to an employee who has to serve the gas undertaking, and that to the best advantage by serving the customer in like manner. We hear it constantly said, in connection with the gas salesman, that he should be a man of good address, courteous, and diplomatic. These are commonplaces in first essentials. We hear, too, that he should know all about the goods with which he has to deal.

We would go further than all such points, and say that the properly qualified salesman should be a man who has had some preliminary practical experience in gas-fitting and in repairing apparatus as an indispensable part of his training, so that he knows what has to be done, what can be done, and is able to detect seats of weakness. He should also be a man of good judgment as to the fitness of things; for a gas salesman who cannot advise as to (say) the size of burners required for a particular situation or purpose, the style of fitting that would be most suitable, or the type of water-boiler or geyser or gas-fire that would be most appropriate, is of no use whatever. He may prove to be a nuisance and a stumbling-block, and the real source of much discontent. We have known cases where gas apparatus has been put into consumers' houses on the recommendation of gas salesmen the inefficiency and uneconomy of which apparatus have created much awkward dissatisfaction; and we have in mind a present case where a gas salesman recommended a certain type of apparatus that was altogether inadequate for the purpose for which it was destined, and it has had to be pulled out, and a fresh type put in. This ought not to have occurred, and it would not have occurred, if the gas salesman had known his business. The salesman ought also to know—this is highly important—all that is worth knowing about competing agents, and keep his knowledge thereupon abreast of progress.

In referring to the information that a gas salesman should possess regarding goods in which he has to deal, Mr. Carpenter draws attention to a "form of analysis," or list of interrogations, bearing upon the character of goods—interrogations the whole of which could not be properly answered without an extended experience of the goods themselves, save, of course, by the manufacturers, some of whom might exercise an undesirable amount of liberty in replying to them. Just by way of example, how is anyone to state the prospective life of an apparatus, until he knows the amount of service that will be demanded from it, and the treatment that it will receive? If he could do so, he would be worth much more than the pay of a gas salesman. However, the subject of the sales department is one that should be considered as broadly and seriously as possible—the more broadly and the more seriously, the better.

National Gas Exhibition and a Letter.

We particularly ask all readers, especially those who are connected with gas undertakings who have not subscribed to the National Gas Exhibition funds, to carefully read and consider the letter from the Chairman at the Executive Committee (Mr. F. W. Goodenough) published in this issue (p. 111). The exhibition is justifying itself in increasing measure day by day. It constitutes a revelation to the public; our electrical friends who honestly express what they think are, by the demonstration, amazed at the advances of the gas industry; and journalists from various parts of the country tell us the ordinary showrooms of gas undertakings have never appealed to them, and carried such conviction respecting the industry's progress in the application of gas as have the numerous successive object-lessons to be found at Shepherd's Bush. A good and stimulating work is being done. The country is being here educated in gas affairs in a manner that has never before obtained. On Saturday, the exhibition was crowded; and it was a perfect pleasure to witness the interest of the public. The knowledge that is being gained at the exhibition by those outside the industry will and must spread; it will not be kept locked up by them. Will those gas undertakings who have not yet helped in the excellent work that is being done, do so now? More money can be advantageously spent; and those administrators who subscribe will always have the knowledge that they did, when opportunity offered, their part in upholding and furthering the interests of the whole industry through this demonstration.

Junior Association Papers.

The new session of the Junior Associations has opened with a smart swing; and the programmes give promise of an excellent amount of material that will be of practical utility. Now, however, is the time to appeal to those who will be reading papers not to be too verbose, or to pad out their papers by unnecessary insignificant detail. We urge this distinctly as much in the interest of the readers of papers as of those who have to listen to them, and those who would be pleased to publish them *in extenso* if not too long. It is quite understandable that the young author of a paper, particularly if it is his maiden effort, may have a feeling that he will make a good impression by an extensive display; but, as a general rule, the impression that is made is an extremely bad one. The audience politely do their best to suppress all signs of their being bored; while people who are not at the meeting, and would probably read a paper that was not over-long, but was brightly and pithily written, positively decline to wade through an author's *copia verborum*. Moreover, we find that it is a tremendous tax on our space to print such papers in full; and authors are disappointed if there is much condensation. But if contributions are not in future of reasonable length, a larger measure of compression must be exercised. For our own part, we would rather the compression came from the authors by voluntary self-repression.

Miners in Conference.

Other matters than the strict business of coal mining occupied a large portion of the Presidential Address delivered by Mr. Robert Smillie at the annual conference of the Miners' Federation of Great Britain. One of them was the lamentable industrial chaos existing in Dublin, as to which it was claimed that the workers are the best judges of the kind of union they shall join. This proposition may be well enough, provided that it is combined with the equally reasonable one that the masters are the proper judges of what men they shall or shall not employ. Coming to questions bearing specially on coal, a word was said in favour of the nationalization of the mines, which the present prosperous state of the industry is felt to justify. From

resolutions passed at the conference, as the result of a private discussion, it would seem that there is a tendency in some districts to make the Minimum Wage Act a maximum one as well. The Federation have decided, by a ballot under the Trade Union Act, to establish a political fund section; but the large number voting against the proposal shows what substantial grounds there were for the previous compulsory levy system. In spite of the heavy charge on the industries of the country which the latest Blue-Book on the subject shows has been made by the Workmen's Compensation Act, the measure does not satisfy the miners. Amendment is asked for in various respects—the alterations suggested having for their object, of course, an increase in the amount of the benefits. There is, however, plenty of time to consider the effect of these proposals. A matter of more immediate seriousness is a resolution, adopted with one dissentient, requesting the Executive to approach other big trade unions with a view to co-operative action in support of each other's demands. It is just mischievous ideas of this kind that have necessitated the formation of an Employers' Defence Union. It must strike one as being unfair to condemn the masters for endeavouring to protect themselves against the state of affairs with which they are threatened.

The Value of an Audit.

A paper of interest to accountants and investors alike was read at the recent annual conference of Incorporated Accountants and Auditors, by Mr. A. E. Woodington, who remarked on the criticism that had been directed to the methods, the work, and the responsibilities of professional auditors. This criticism, it was said, has been directed mainly to the value placed upon fixed and floating assets in the accounts of limited companies, certified in the opinion of the auditors to exhibit a true and correct view of the position of the business at a certain date. This statement of opinion must mean, argued the author, that the auditor, having exercised all the care, skill, and discretion at his disposal, presents his views to shareholders, the great body of whom rely, and quite rightly reply, upon his judgment. He believes that the vast majority of shareholders understand perfectly well that the valuations of assets appearing in a balance-sheet are not break-up values; but if this is not admitted, it seems to him the form of auditor's report prescribed by Parliament in the Companies (Consolidation) Act of 1908 should be amplified, and auditors should be required to state whether, in their opinion, the balance-sheet exhibits a true and correct view of the state of the company's affairs as a going concern—this being the only possible basis to go upon. In the course of the paper, the remark was made that the value of auditing would be increased if the apathy or indifference of shareholders could be overcome. There is no doubt much truth in the view that shareholders look for dividends, but that for the most part their interest in the accounts of the concerns in which they have placed their money becomes acute only when dividends are lessened or temporarily cease. Prospective investors could do much to save themselves subsequent disappointment, and perhaps loss, if they would take heed of Mr. Woodington's statement that to get an accurate view of the position and progress of a company, it is necessary to see, examine, and compare the balance-sheets of several years. How many investors or members of the general public, he asks, take this trouble, either themselves or through those who advise them, before buying shares or making investments?

Coal Exports and Home Prices.

Several chairmen of gas companies have contended that the high prices for coal are partly due to its export to other countries. Therefore the anomaly of the community and the industry of this country having to suffer severely through the coal owners supplying purchasers abroad without restriction and without the foreign buyers doing anything in the way of compensating the British nation for the heavy draft made upon their fuel resources. The recently issued Board of Trade return relating to the foreign trade during September provides strong support for those who hold that the influence of the export trade is greater in the upholding of prices than the conditions of home trade. In September, for example, the quantity of coal and coke exported was more by 200,967 tons than in the corresponding month of last year; and the value of the coal and coke exported was more by £550,998. But these figures are not so striking as are those of the nine months of the year. Under the item of coal, coke, and manufactured fuel, the total value for this period is given as £39,755,893, which is greater by £9,816,727 than in the nine months ending with September last year. Of course, the first part of last year included the period of the great coal strike; but the enormous rush for coal from abroad prior to, and immediately after the termination, of the strike, went to largely fill up the void made in shipments during the period of the strike. In view of this, there is a big significance about the figures found in the present return.

PERSONAL.

Mr. J. W. MACKAY, of the Shanghai Gas Company, Limited, who has been home on leave of absence, is returning to Shanghai on the 23rd inst.

The vacancy caused by the removal of Mr. W. H. Johns to Malvern has been filled by the appointment as Superintendent at the Saltley works of the Birmingham Corporation Gas Department of Mr. C. C. BARBER, who is at present Superintendent at the Adderley Street works. Mr. Johns's Assistant, Mr. R. A. S. BROWNING, goes to Adderley Street to fill the position vacated by Mr. Barber.

Referring to the paragraph in the "JOURNAL" last week on the subject of the lectures at the Smethwick Technical School, we learn that Mr. Stone will only deliver those on "Gas Engineering;" Mr. R. J. ROGERS, the Lighting Superintendent and Chief Commercial Representative of the Birmingham Gas Department, having been appointed to give the lectures on "Gas Supply" in both the first and the final grade.

We learn from the "Journal für Gasbeleuchtung" that Herr F. REESE, who is now President of the German Association of Gas and Water Engineers, has just completed a term of forty years as Manager of the Dortmund Water-Works, and has naturally been the recipient of many congratulations thereon. Herr Reese is very largely responsible for the preparation and issue of the German Association's periodical volumes of water-works statistics, which are unequalled for completeness by any similar publication in other countries.

OBITUARY.

The death is announced of Mrs. MARY ANN WHITAKER, widow of Mr. W. Butler Whitaker, M.Inst.C.E., who was for many years Engineer of the Argentine Gas Company of Buenos Ayres, and whose death was recorded in the "JOURNAL" for Feb. 14, 1911. The deceased lady was in her seventy-fourth year.

We are sorry to have to record the death of Mr. JOHN SURMAN, who was for over forty years Chief Storekeeper to the South Metropolitan Gas Company. He died on Oct. 6, within four days of his 77th birthday. He entered the Company's service under the late Mr. Thomas Livesey, at the age of 14 years (Sir George Livesey then being junior clerk in the office), and retired in March, 1906. The funeral was on Saturday at Forest Hill Cemetery, and was attended by the Secretary and many of the chief officials of the Company, as well as by a number of representatives from the Stores Department. The wreaths, which were very numerous, included several from the Company's staff, and notably one from the Chairman, Mr. Charles Carpenter, D.Sc.

The death occurred last Thursday, at his residence in Gower Street, W.C., of Mr. SOPHUS SIMMELKJÖR, who was for many years General Manager and Engineer, and afterwards a Director, of the Cagliari Gas and Water Company, Limited. Under his supervision, the works of the Company and the water supply of the city were greatly improved. He was held in the highest respect not only by the Chairman of the Company (the late Sir John Aird) and the members of the Board, but by the entire body of officials and employees. Before the undertaking was transferred to the Municipality at the close of 1908, Mr. Simmelkjör rendered valuable assistance in arranging the terms. This was only possible because of his intimate association with the authorities for twenty-five years as the Company's representative in Cagliari, and because he remained during the whole of the time on good terms with them. When the Company was voluntarily wound up, he was appointed one of the Liquidators. Mr. Simmelkjör was an associate member of the Institution of Civil Engineers, having been elected in May, 1895. He joined the Gas Institute in 1901, and passed into the Institution, of which he was a member till his death. He was one of the first members of what is now the Institution of Water Engineers, and was a fairly regular attendant at the meetings. He was a Freemason, having joined the Evening Star Lodge in 1892. Deceased was in his seventy-ninth year.

The Oldham Corporation Gas Committee have placed with Messrs. Robert Dempster and Sons, Limited, of Elland, a contract for the erection of vertical retorts, on the Dempster-Toogood continuous system, equivalent to a production of a million cubic feet of gas per day. Previous to arranging for this installation, the Committee inspected the plant erected on the system named at the Hebden Bridge Gas-Works—as referred to in last week's "JOURNAL," p. 40.

THE NATIONAL GAS EXHIBITION.

INTERNATIONAL EXHIBITIONS HALLS, SHEPHERD'S BUSH.

[Entrance in Uxbridge Road.]

OCTOBER 1 TO NOVEMBER 1.

Organized by the Leading Gas Companies and Corporation Gas Committees of the United Kingdom and the Society of British Gas Industries.

President - SIR CORBET WOODALL, D.Sc., M.Inst.C.E.

A LETTER FROM THE CHAIRMAN OF THE EXECUTIVE COMMITTEE.

SIR,—All friends of the Exhibition will be glad to learn that the attendance of the public, which was large from the very first, is steadily increasing, and that the resultant inquiries (circulated at once throughout the country to the undertakings concerned) are both numerous and promising.

The view which the public generally is taking of the Exhibition is well expressed in a letter that I have just received from a friend quite unconnected with the industry, and having no knowledge whatever of the scheme beyond that derived from his observations on a visit to Shepherd's Bush. He remarks: "The organizers have studied their visitors' comfort in all sorts of delightful ways, one of the most charming being the total elimination of those pests of exhibitions, the touting stall-holders. One could stop and look without being pestered to buy."

Probably some of our friends still have their secret doubts as to the wisdom of abolishing the stall and its holder—especially those who regard a gas exhibition as primarily intended to form a ground upon which to canvass the gas manager. But, from every available source of evidence, it is quite certain that the public have no two opinions on the matter; and it is the public we want to interest and please.

A very eminent electrician told me to-day that he was sending all his friends to see how an exhibition should be organized from the point of view of the visitor.

All that we want now is the financial support of those who have previously not realized the national value of the enterprise. A glance at our press-cutting books would soon remove any lingering doubts as to the national interest it is arousing.

May we not hope to include *every* undertaking in the country on the list of subscribers when we publish the balance-sheet? We could profitably spend several thousand pounds more than we have got. Will managers kindly bear this in mind, and do all they can to secure the support of those outside the list?

The purchase of copies of the Official Guide, sufficient to supply one to each member of Committee or Board (subscribing and non-subscribing alike), would do much to bring the character of the Exhibition home to both friend and indifferent. They can be had at 5s. per dozen.

F. W. GOODENOUGH,
Chairman of Executive Committee.

Shepherd's Bush,
Oct. 11, 1913.

NOTES FROM THE EXHIBITION.

The Right Hon. John Burns, accompanied by Mrs. Burns, visited the National Gas Exhibition at Shepherd's Bush on Tuesday evening. He was conducted round the exhibition by Mr. F W. Goodenough, the Chairman of the Executive Committee, and Mr. H. M. Thornton, the Vice-Chairman. Mr. W. D. Helps, Chairman of the Council of the Society of British Gas Industries, accompanied Mrs. Burns. Mr. Burns evinced special interest in the exhibits relating to sanitation and hygiene, and spent a considerable time in studying institutional heating, lighting, and ventilation, as illustrated by the hospital wards and schoolrooms. Mrs. Burns was most interested in exhibits appertaining to the homes of working men.

If the executive officers of gas undertakings find that their boards of directors or members of committees show any indisposition to visit the exhibition, it would perhaps stimulate them into coming to London if they each had a copy of the official guide and programme presented to them (the cost is only 6d. per copy), and were shown the photographic views published in the "JOURNAL" last week, together with those which appear in the current week's issue.

It is impossible to mention the names of all gas undertakings whose directors and committees have already visited the exhibition, as it is beyond the power of any man to live at the exhibition, and at the same time attend to journalistic work. Last week there were many gas administrators from all parts of the country at the display, obtaining interest and instruction from the numerous object-lessons.

Occasional trips to the exhibition brought us into contact with a few of the parties. The Manchester Corporation Gas Committee were there, and very enthusiastic over what they saw. Accompanied by the Chairman (Mr. Councillor W. Kay, J.P.) and the Deputy-Chairman (Alderman Jennison, J.P.), the Engineer (Mr. J. G. Newbigging), and the Superintendent of the Department (Mr. F. A. Price), all the members of the Committee but three came up to London. They formed quite a large party. They were at the exhibition on Tuesday night, when Mr. Councillor Kay presided at Professor Lewes's popular lecture on the "Evolution of Gas Lighting and Heating." They inspected the lighting during the evening, and were there again betimes on Wednesday making a more detailed investigation of the vast show.

Alderman W. H. Batchelor, the Chairman of the Coventry Corporation Gas Committee, accompanied by most of his colleagues,

and Mr. Fletcher W. Stevenson, the Gas Engineer, were at the exhibition on Wednesday.

Among other friends who were met the same day were Alderman F. S. Phillips, the Chairman of the Salford Corporation Gas Committee, with Mr. W. W. Woodward, the Engineer.

Also seen was a party of the Directors of the Wellingborough Gas Company, with their Engineer, Mr. John T. Lewis.

Some of the members of the Midland Gas Association, with the President (Mr. W. S. Morland) and the Hon. Secretary (Mr. W. W. Townsend) made an inspection on Wednesday. They had an informal lunch together, with Mr. F. W. Goodenough as their guest.

Before they could have seen our suggestion of last week with reference to bringing local journalists to the exhibition, we found Mr. Thomas Berridge escorting three of our colleagues of the Leamington press; and Mr. J. W. Auchterlonie was also observed pointing out the features of the place to journalists from Cambridge. This is one way of doing good publicity work in every gas-supply area.

The Eastern Counties Association held their meeting at the exhibition on Friday; and a report appears in other columns. Their President this year being the Chief Engineer of the Gaslight and Coke Company (Mr. T. Goulden), the members were the guests of the Company at luncheon.

There was a big attendance at the exhibition on Friday night. A good programme of music had been arranged for the members of the Eastern Counties Gas Managers' Association in the Reception Room. The public found it out, and took possession of the place; and members of the Association had to take back-seats. The lectures and cookery demonstrations were well patronized; and there were plenty of people about all the galleries. This is the common experience of the week.

Professor Vivian B. Lewes demonstrated on Thursday—if demonstration were needed—what an incomparable lecturer he is, and what a bad reader of a paper he is. In conformity with the programme, he had prepared a paper on the subject of coal smoke abatement, and commenced seriously to read it. Almost every few minutes, however, he found himself in his characteristic lecturing attitude oblivious of the printed paper on the reading-desk. Suddenly realizing this, he stopped short time and again with the remark: "I must get back to the paper." Those who knew him smiled.

A story was going round last Friday which was up-against the B.C.G.A. A certain lady wrote asking for full particulars to be sent to her concerning the rotary meter. She also desired information as to the best way of registering the amount of gas used by the fire in each room of a hostel for lady students in which she is interested. Her letter also stated that she was unable to gain information on the point at the exhibition, as she had hoped to do. That is bad; we cannot judge as to where the fault lies. The story runs that the Association, in response to the request, sent the correspondent information as to ordinary prepayment meters! Mistakes will happen sometimes in the best of regulated families; but it must have been galling to our friend Marsh to hear of this one.

The "Electrical Times" in its reference this week to the exhibition is filled with envy, malice, and all uncharitableness. It seems to have been hunting for paltry points on which to base criticism, and in consequence overlooked all that is good in its agitated ineffectual search. With mantle-making going on in the Industrial Hall and numerous unhooded gas-furnaces running full blast, there is naturally a slight smell in that region. Our contemporary found it, and waxed sarcastic. It does not like to see a corset shop, a tobacconist's, and sweet shop in the arcade. Its superior nose turns up at such things in an exhibition. It does not like the furnishing of some of the rooms. It finds some fire extinguishers about the place. A whole fire brigade was in evidence at the Manchester Electrical Exhibition, and fire extinguishers are sometimes advertised in the electrical papers. The same articles are found in every electric-lighted theatre in London, and in every place where the public assembles. It is also asserted that the waitresses in the exhibition were suffering from headaches and fainting during the first week of the exhibition. Next, please.

In an aside during the reading of his Presidential Address at the meeting of the Eastern Counties' Gas Managers' Association last Friday, the Chief Engineer of the Gaslight and Coke Company (Mr. T. Goulden) remarked, when referring to the exhibition, that during the last six months Mr. F. W. Goodenough had done three men's work; and he (Mr. Goulden) was quite convinced in his mind that the success of the exhibition was due more to Mr. Goodenough's untiring work than to any other factor that had entered into it.

This week will be flush with event at the exhibition. There is to be the reception on Thursday of the patrons of the exhibition by Sir Corbet and Lady Woodall. The two conferences to-day and Friday will be on most important subjects. The hygiene of gas lighting and heating will be discussed to-day; and on Friday various aspects of illumination will be considered. Visits of Gas Associations are arranged for, including a joint visit on Saturday of the Junior Associations. The following week will also be a big one, with the British Commercial Gas Association holding their annual meeting, and the international conference of sulphate of ammonia makers succeeding.

Sir George Kekewich, who presided over the Conference of Educationists on Saturday, was in a particularly happy frame of mind throughout. When reminded of this fact by Mr. Goodenough, who was proposing a vote of thanks to him at the close of the Conference, Sir George retorted that he had been seen at his best that day, and mentioned that, on the following two days, he would be speaking at a Brotherhood and a Socialistic meeting respectively, when the speeches would not be quite in the same friendly spirit as had been the case at the Conference.

Discussing the effect of bad illumination upon the eyesight of children, Sir George made a neat thrust at Eton College, where he was educated. Commenting on the fact that his eyesight now—he was born in 1841—was as good as ever it was, he said he was no doubt indebted to the school for this. In his day, the college authorities knew nothing about lighting, and cared less; but this did not matter as the boys never had to read anything, and so their eyes never suffered. The boys were out in the open air all day, and played cricket, and rowed, and generally enjoyed themselves. Education was left for a later date!

There was an amusing little guessing competition between Mr. Goodenough and Professor S. P. Thompson on Saturday during the reading of the paper by the latter at the Conference of Educationists. Professor Thompson was suggesting that very few people had the faculty of predicting the degree of illumination on any particular surface. He thereupon proceeded to measure the illumination on the wall behind the Chairman; Mr. Goodenough having guessed 7½ foot-candles. The Lumeter showed it to be 8; and the laugh rather went against the Professor. A sheet of white paper was then placed on the platform table; and Mr. Goodenough guessed 14 foot-candles. Professor Thompson brought the laugh back to his side when he announced that the Lumeter said 21 foot-candles. Having enjoyed the laugh against Mr. Goodenough, the Professor raised another by admitting that he himself had fixed, in his mind, upon 13 foot-candles.

A printed advertisement circular was littered about parts of the exhibition one day last week. We understood this sort of thing was not to be permitted.

The "JOURNAL" appears to be in great demand at the Exhibition. A copy was placed on the reading-stand in the newspaper room last Friday afternoon. It was not there long before someone appropriated it. "Appropriated it" is, in the circumstances, a courteous expression. Anyone requiring the "JOURNAL" at the exhibition can obtain it at the bookstalls of Messrs. W. H. Smith and Sons in the exhibition, at the ordinary price.

The number of visitors on Saturday was swelled by a contingent of some 300 officers and men in the service of the Birmingham Corporation Gas Department. The visit and the particular conditions under which it was made deserve special mention, though, of course, the party did not appreciably augment the crowd of people met with in different parts of the exhibition. Indeed, of the many striking features, perhaps the most striking of all on Saturday evening was the big attendance of the public. Granting that Birmingham has not much to learn from other places in connection with selling gas, and remembering that the Department are every year excellently represented—or, perhaps it should be said, excellently represent themselves—at a large local trade exhibition which has a run of many weeks, it may still be confidently hoped that many useful wrinkles were picked up during the inspection of the industry's great co-operative effort at Shepherd's Bush.

The visit of the 300 representatives of the Birmingham gas undertaking was admirably planned and carried out. The party was under the leadership of Mr. S. R. Barrett, the Fittings Superintendent, and consisted of various heads of departments, and officers and men connected with the works, the fitting department, and the commercial staff. The outing was, of course, for education purposes; and it was so regarded—the members of the party making the most of the opportunity afforded them of carefully studying the contents of the exhibition. The special train was due to arrive in London shortly after noon, and the return was arranged for about eight o'clock. The intervening hours afforded a very good opportunity of seeing all that there is to be seen. Next Saturday, there will be another party coming up; but the number it is expected will be about 100.

The Birmingham Corporation Gas Department, realizing that the visit would have a solid educational value, and that they would benefit from any knowledge their employees gained, did everything possible to make the day a pleasant one. The party were conveyed to the exhibition and given tickets for refreshments; while a day's pay was allowed to each workman. And as a further inducement to the careful examination of the exhibits, the Gas

Committee are offering prizes for the best report, illustrated by drawings, of apparatus and novelties observed in the exhibition. The first prize is three guineas, and the second prize one guinea; the competition being open to all fitters and junior fitters. Prizes of equal value to those named are offered to members of the staff for the best two illustrated articles that may be published later in the "Birmingham Gas Department Magazine." On arrival, the men were formed into parties, under leaders previously determined upon; and so the inspection was made under the best possible conditions. During the return journey, supper was served—for which purpose three or four restaurant saloons were attached to the train.

The "Engineering Gazette" is the "House Journal of Marryat and Place, of Hatton Garden;" but there is someone on the staff of the paper who is peculiarly ignorant of the relative positions of the appliances of gas and electricity. He writes his certificate of ignorance in the following terms: "There can be relatively few people in the world who actually admire gas lighting, and fewer still who regard the gas-engine as a convenient source of power. Electric lighting is now every bit as cheap as gas lighting (and it is infinitely more cleanly and convenient), while—once more on the scores of economy, cleanliness, and convenience—the electric motor is such a long way ahead of the gas-engine for power purposes that the utility of electricity in this direction is everywhere taken for granted." Yet the writer goes on to say that he has no "hesitation in describing the general arrangements and exhibits at the National Gas Exhibition as being excellent, and well worthy of a visit by everybody, directly, indirectly, or even remotely interested." On the same page of the paper it is stated that "the total revenue of the Gaslight and Coke Company last year amounted to £5,090,478. In the previous year the total revenue was £4,654,833." There appear to be a few people still in existence who believe in gas.

A page of the "Graphic" is occupied this week by an article entitled "Towards an Ideal." It is illustrated centrally and around the borders. The border pictures show how gas has enabled domestic life to move from the crude to the ideal state in the matter of lighting and heating. From dirt, labour, inconvenience, and discomfort, we have passed to cleanliness, ease, convenience, and comfort. The article within this border discloses the artist in thought and words; for it is most picturesquely written. It is a timely contribution during the National Gas Exhibition. The drawings are by Mr. David Wilson, and the article by Mr. C. M. Wilson—two brothers; the last-named gentleman being Chief Assistant to Mr. R. W. Edwards, the General Manager and Secretary of the Aldershot Gas, Water, and District Lighting Company. The date of the "Graphic" in which the joint artistic production appears is Oct. 11.

In our general account of the exhibition a fortnight ago, we referred to the "B.S.T." compressors and lamps on the stand of Messrs. Bilbie, Hobson, and Co. A little interesting information was then omitted, which may now be given. The gas-compressor is combined with an air-compressor, and attached is a mixing-chamber where the gas and air are united; the proportions being 95 per cent. gas to 5 per cent. air, to 90 per cent. gas and 10 per cent. air according to the quality of the gas; so that in no case is there an explosive mixture in the pipes. The gas and air compressor proportions are brought together in the pipes, so that the pressure of both is always the same. The object of this is to obviate taking in air at the lamps; and thus there is no necessity to regulate each lamp separately. There is an adjusting-screw fitted in the mixing-chamber, whereby all lamps can be regulated together, resulting in a great saving of time and attention. The system enables the lamps to be used in places where the atmosphere is unclean. The illuminating power of the lamps that are being exhibited is 250 candles. They are made with bayonet fittings, so that they can be quickly taken down for cleaning purposes.

Referring last Thursday to the National Gas Exhibition, "Nature" said: "The exhibition affords the best object-lesson in gas lighting that the public has ever had the opportunity of studying; and the fascination is greatly increased by the absence of competing stalls—the exhibits being shown in model rooms, shops, studios, &c., under all the conditions in which they are likely to be used in practice. It is something of an achievement to have induced the leading gas undertakings, municipal and private, and the leading manufacturers of gas appliances in the United Kingdom, to sink their individuality and rivalry, and to co-operate in a coherent exhibition of the varied uses to which gas can be efficiently and profitably applied. The result should be of benefit both to the industry and to the public generally. The exhibition impresses one with the enormous strides that have been made during the last few years in the application of gas for manufacturing, domestic, and public purposes."

CONFERENCE ON COAL SMOKE ABATEMENT.

THE second of the conferences arranged in connection with the exhibition was held last Thursday, when the whole day was devoted to consideration of the subject of smoke abatement—four papers being read. Sir WILLIAM H. BENNETT, K.C., V.O., F.R.C.S., presided at the morning session.

Mr. F. W. GOODENOUGH (the Chairman of the Executive Committee), in opening the proceedings, said the meeting was honoured in having in the chair Sir William Bennett, who had always shown the very keenest interest in smoke abatement questions. Perhaps it was necessary that he should explain that the Duke of Argyll accepted the presidency of the conference on the distinct understanding that he knew it would be impossible for him to be present; but he wished to show to the public that he took a very great interest in these questions. For the same reason, Princess Louise, the Duchess of Argyll, gave her name as a Special Patron of the conference. He should like to add that the organizers of the National Gas Conference called this conference because they were believers in the smoke abatement movement as a great movement on behalf of national health. The gas industry believed that they could do, as they had done, a great deal to forward the movement; and they did not expect, and had never asked, the Coal Smoke Abatement Society to act as a *pro*-gas society in any sense, but purely and simply as a smoke abatement society. Only so long as the gas industry could establish its claims to provide an economical smokeless fuel, only so long did the gas industry claim to be able to take a prominent part in the smoke abatement movement. If any other type of fuel could be produced that would achieve the same results with greater satisfaction to the public, the gas industry would stand aside, and feel that the interests of the public were being served in other directions. Only so long as they could give a service to the public did the gas industry hope for any support from the Coal Smoke Abatement Society or any other society having at heart the benefits of the people as a whole, as distinct from an individual industry. He was sure everybody would feel very much indebted to Sir William Bennett for giving up his valuable time to be present that morning, and the thanks of the meeting were also due to the readers of the papers.

The CHAIRMAN, prior to reading his paper (some extracts from which are given below), said there was one difficulty which everybody who dealt with the question of smoke abatement felt—viz., that there was nothing new to be said about it, because so much had been said already. But the public generally, or a very large section of them, did not quite realize the importance of the question, and did not take so much interest in it as they should; and therefore the only thing to do was to "peg away." This was what the Coal Smoke Abatement Society was doing now; and it was hoped the objects of the Society and of the conference would be furthered by again "pegging away."

COAL-FIRES AND FOG—THEIR EVILS AND THE REMEDY.

In his opening remarks, Sir William pointed out that the smoke nuisance, due to the employment of coal as a fuel mainly in open grates, which weighs so heavily upon the dwellers in large towns, arises from two sources which are in a sense distinct—viz., factories, locomotives, and other smoke-producing concerns (industrial smoke), which are under the control of the local authorities; and the domestic hearth, which he was afraid was responsible for the greater part of the trouble in the majority of cases. The defects of the open coal-fire were: (1) The production, mainly from imperfect combustion, of smoke and harmful gases, leading to the formation of fog; (2) extravagance from waste of heat; (3) danger of fire from over-heated flues and neglected chimney soot, &c.; and (4) dangers to health, principally in connection with fog. Against these defects must, however, be placed to the credit of the open coal-fire the fact that it ensures ventilation—a very important factor in domestic heating.

The principal trouble arising from smoke is, of course, fog; but in recent years, thanks, no doubt, greatly to the action of the Smoke Abatement Society, there has been a considerable diminution of fog in London, though the rate of diminution has been somewhat erratic. The maximum number of fogs in recent times seems to have been reached in 1886, when by a curious coincidence there were 86 days of fog; but latterly the number of fog days has been as low as 10 in a single year. In regard to the second defect of the open coal-fire—extravagance from waste of heat—Sir William showed that not more than 25 per cent. at most of the heat units are utilized in warming the room. There is consequently a loss of 75 per cent. of the heating power of the fuel consumed. The same way there is an immediate loss of between 6 and 7 per cent. of the actual fuel in the form of soot thrown off in the smoke. So that, assuming the amount of coal used in this country to be 35 million tons, or thereabouts, the immediate waste is something like 2 million tons of fuel. Putting this into money figures, the actual loss, allowing for the different prices in different localities, can hardly be less than £2,000,000 annually.

Dealing next with the effect of fog upon the death-rate, the

A GROUP OF THE EXHIBITION STAFF, WHO ARE IMPARTING INFORMATION TO THE PUBLIC.

[This and the other photographs of the exhibition have been taken for the "Journal" by Messrs. John H. Avery and Co., of Hillmarton Road, London, N.]

speaker quoted the Hon. Rollo Russell, who, in a pamphlet on "London Smoke," states that in a bad fog in London in 1880 the death-rate rose in a fortnight from 27·1 in the week ending Jan. 24 to 48·1 in the week ending Feb. 7; and the number of deaths rose to 2994 above the average. In Croydon, during the same period, the number of deaths rose only from 35 to 36; the town being outside the radius of London's dense fogs. Last year a foggy period set in late in September, when the death-rate was 12·2 per 1000. For the opening week in October, the rate went up to 13·3, for the second week to 15·5, and for the third week to 16·8—an increase of nearly 40 per cent. in a short time; the 1454 deaths registered during the week ending Oct. 19 being 332 in excess of the normal for the period. In 1892, after a heavy fog, there were 1484 additional deaths in a week in London. Another severe fog took place during Christmas week in 1891, and lasted for six days. During the succeeding five weeks, the deaths from diseases of the respiratory organs amounted to 6306—exceeding the normal by 3349. The Medical Officer of Health for Manchester (Dr. Niven), in a paper read at the Smoke Abatement Conference at Manchester in 1911, dealt with the effect of the relation of smoke and health; and he showed that, in the case of six periods of fog, 1476 extra deaths occurred from phthisis, 1335 from pneumonia, and 2156 from bronchitis. In Glasgow, in the year 1909, during a period of five days of dense fog, the weekly death-rate from bronchitis, pneumonia, and pleurisy rose from the October average of 35 (or 2·1 per 1000) to 233 (or 13·9 per 1000) for the week ending Nov. 27. During two periods of fog in 1909, the death-rate rose from 18 to 25 per 1000—1063 deaths being attributed to the fog.

Having considered the subject of the relation of the domestic fuel used to cancer, and pointed out the effects of fog upon milk and plant life, Sir William proceeded to indicate the remedy for the smoke evils to which he had called attention. Briefly stated, it is the adoption of oil, gas, and electricity for obtaining heat for domestic purposes. As there are great difficulties in the way of using oil, the speaker was reduced to the consideration of the relative merits of gas and electricity. This he proceeded to do; his remarks being as follows:

In discussing the substitution of gas for coal-fires, the first question which invariably arises is that of cost. At first sight, the gas-fire appears to be four or five times as expensive as coal when the price of fuel and the number of heat units only are compared. In reality, however, if effectiveness be considered, gas is probably quite as cheap as coal, in consequence of the enormous waste of heat energy in connection with the use of the latter; and if indirect saving of expense by the cleanliness of gas, the lessened damage to interior decorations and fabrics, and the saving of labour be taken into account, the balance would probably be largely in favour of gas. In my own experience, for example, a room heated solely by a gas-fire remained clean and presentable, so far as paint, decorations, &c., were concerned, for nine or ten years; while another room, in which coal-fires only were used, required renovation three times in the same period. That gas can do everything in the way of heating, cooking, &c., that coal can do is certain—being at the same time cleaner, smokeless, and labour-saving. It can also be equally sanitary. I say *can* advisedly, because the healthiness of the gas fire in domestic life depends entirely upon it being properly installed. A badly installed gas-fire is an abomination and a menace to health; while, if properly installed, a more wholesome heat-provider could hardly be found.

As I have already said, the most valuable asset of the coal-fire, from the sanitary point of view, is that the automatic ventilation of an open chimney is a necessary part of it. Precisely the same thing holds good with the gas-fire if properly installed, which is impossible without the use of a chimney or fire-shaft. Hence a properly installed gas-fire ensures a certain amount of ventilation, as does a coal-fire; and I am strongly of opinion that no form of heating is really suitable for domestic purposes, and indeed should not be permitted by law in certain circumstances, which does not provide automatic ventilation in this way. In spite of the free preaching of the gospel of the open window, many people, more especially among the poorer classes, still insist on closing every channel admitting air—a dangerous habit, and a serious menace to health which is lessened by the automatic ventilation provided by a chimney or fire-shaft.

Although the potentiality of electricity is infinite, it does not appear at present to offer anything like, as a heat producer, the complete substitute for coal that is afforded by gas—at all events, so far as a complete heating system, at a reasonable cost, for domestic purposes, including ordinary heating, cooking, hot-water supply, &c., is concerned. The electric cooker has much to commend it. The electric radiator is a convenient means for room warming, and may afford an efficient substitute for hot-air or hot-water pipes, although the question of expense would be a somewhat serious consideration. The most perfect system for an ordinary house would probably be provided by using electricity for lighting; gas being employed for all purposes of heating.

In conclusion, I feel confident in saying that the discontinuance of the coal-fire for all purposes of domestic heating, and substituting for it a smokeless fuel, the most efficient at present being gas, will lead to a brighter London, a more robust and efficient urban population, and may go far towards dispelling the feeling of gloom and pessimism which is too prevalent at the present time.

The Honourable Rollo Russell, in proposing a vote of thanks to Sir William Bennett for his paper, said he had in past years investigated to a considerable extent the effect of smoke on the air and upon the health of the people, also to some degree its effect on plant life; but he had not gone closely into the question of gas as a complete substitute for coal for heating purposes. Everybody was aware of the wonderful improvements which had taken place in lighting by gas, and some knew the very great improvements which had also been made in heating. He himself had only lately come to live in London, and had been rather struck first of all by the brightness of the air, which he believed had not always been the case, and, secondly, with the improvements in gas-heating appliances. He had had a few of these installed in his own house with, so far, satisfactory results. He could not say that he shared the very hopeful views as to the abolition of fogs in London; but he had no doubt that these would, to a very great extent, be reduced from what had been the case in the past, owing to the increasing use of gas. Certainly he believed the time had now come for some very definite and strong

THE DRAWING-ROOM IN THE LARGE TOWN HOUSE.

action in the direction of abolishing the bad conditions of smokiness generally in London and other large cities.

Mr. PERCY TUBBS, the President of the Society of Architects, seconded the vote of thanks, and said that he was a very great believer in gas-fires, having adopted them throughout his own house. Architects were keenly interested in the subject of smoke abatement, and everyone should do all he could to reduce smoke, for buildings would last very much longer and look much better if they could only get rid of it.

Mr. F. W. GOODENOUGH, in putting the vote of thanks to the meeting, referred to a point which Sir William Bennett had brought out—namely, with regard to fuel and cancer. In his remarks upon this, Sir William rather pointed to the fact that the amount of sulphur given off by the fuel consumed had a direct bearing on the incidence of cancer in a district, and it might be remarked that gas sent out for consumption as a fuel contained only an infinitesimal portion of the amount of sulphur which was in the coal used for the manufacture of the gas. Practically, the whole of the sulphur was taken out in purification or in the coke.

THE GAS INDUSTRY IN ITS RELATION TO SMOKE ABATEMENT

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

Before attempting to discuss the important part which the gas companies are playing in reducing the smoke plague, which is the great blot on England's sanitary reputation in the Twentieth Century, I should like to discuss, rather more fully than is usually done, the true nature of smoke and the causes that lead to its formation.

Paper, wood, and coal represent the combustible factors in starting the domestic fire. When the fire is once well alight, then coal alone becomes the fuel. Both paper and wood have as their combustible basis cellulose; while bituminous coal contains carbon and degradation products of cellulose luted together by resins and hydrocarbons. In all three, the ash, which represents the mineral constituents derived largely from the sap, is the only portion that plays no part in combustion. If we analyze a sample of dry wood and one of bituminous coal—such as is employed usually as a household fuel—we obtain the following results for the main constituents:

	Dry Wood.		Domestic Coal.
Carbon	48	..	86
Hydrogen	6	..	5
Oxygen	46	..	9

And the composition of paper, when the ash is deducted, will not differ materially from that of the dry wood.

We know from experience the wide difference which exists between the smoke from wood and from coal—the one consists chiefly of steam with small quantities of creosotic and acetic vapours and fine particles of ash; the other of soot, heavy tar vapour, steam, sulphur compounds, and ash. No finer illustration of the effect of the two fuels on the air of a large city could be adduced than the atmospheres existing in Paris and London respectively. Up to the year 1890, the amount of coal burnt in Paris was negligible. Wood was the universal fuel there; and the atmospheric conditions were well-nigh perfect. Since then, coal has commenced to play an important part as a domestic fuel; and the consequent deterioration of the condition of the air is perfectly noticeable. In London up to 1890, neither wood nor gas in any way interfered with the use of bituminous coal; and the condition of the air was a national disgrace.

A glance at the composition of the two fuels makes the cause of this clear. In the wood, we have not much more than half the carbon that is present in the coal; while there is five times as much oxygen. When a fuel containing combined oxygen burns, the old idea was that the oxygen present in the compound must be looked upon as combined with the hydrogen; and as in the wood the weight ratio of the hydrogen and oxygen is nearly the 2 : 1 required for the formation of water, the decomposition of the wood during combustion should give rise to nothing but steam and oxides of carbon—in other words, no true smoke should result. This, of course, is not so. When a compound like the cellulose of wood burns, the action is partly combustion and partly destructive distillation. In the latter case, the oxygen will partly form water and will partly combine with both hydrogen and carbon to form oxygenated hydrocarbons, like the creosote that gives the wood-smoke its curative properties, as when used for the curing of hams, &c. Moreover, some of the hydrogen combines with carbon alone to form hydrocarbons. But where the oxygen is high and the carbon low, as in wood, these are of a simple character, and consist of little more than traces of methane, and no black carbonaceous smoke is formed. With coal, on the other hand, the carbon is high and the oxygen low—a fact that makes the calorific value of coal nearly double that of wood, but at the same time leads to all the troubles that we are fighting against in smoke abatement.

When using bituminous coal in the domestic grate, there are three distinct phases in the burning of the fire. In the first, coal has just been fed on to the fire, and the result is a maximum of distillation and a minimum of combustion. It is during this period that the most deleterious constituents of the smoke are formed, and a very large proportion of the heat units in the coal are lost, owing to the amount taken up in decomposing the coal and converting the volatile portions into vapours and gases. During this period, the coal, heated by the fire from below and comparatively cool above, distils off tar vapours, coal gas, and steam in proportions which vary with the temperature. At first, the surface of the fuel being too cool to lead to their ignition, these products escape as vapours up the chimney, mingled with anything from 8000 to 30,000 cubic feet of air per hour, according to the draught in the chimney. In an ordinary flue, an analysis of the escaping products would give an approximation to the following:

Carbon dioxide	0·70
Methane	0·36
Hydrogen	0·29
Carbon monoxide	0·01
Oxygen	19·85
Nitrogen	78·79—100

These gases, together with water vapour, escape up the chimney.

During this period of smoke production no soot is formed. The physical properties of the cloud of vapour provide an interesting study, as they explain one of the secrets of the lasting power of smoke, and the way in which it acts. A most beautiful and instructive experiment shows to perfection the structure of smoke as it escapes from a burning object. A puff of smoke blown through a small glass cell illuminated from below by oxy-hydrogen or arc light, and examined under a low-power microscope, reveals

the fact that it consists of excessively minute vesicles, which are in a marvellous condition of motion, and which will remain floating in the stream of air or gas until impact with a solid surface causes a bursting of the little liquid envelope, forming a microscopic drop of tar on the solid against which it has struck and liberating the contained gases. This ends the first phase in the actions taking place.

After a period which varies according to the amount of coal which has been fed on to the fire, sufficient heat finds its way to the top of the fuel to ignite some of the escaping vapours, and the bright illuminating flame is then formed above the surface of the fire. This flame radiating a considerable amount of heat, owing to the incandescent particles within it, the waste ceases to be as great as before; but a large amount of vapour will be noticed to be escaping still unburnt, owing to some of the hydrocarbons being so diluted with steam and the cold air sucked in over the surface of the fire as to stop their combustion. If the flames themselves be watched, it will be seen that they become red and lurid towards the top, and are emitting particles of carbon. It is during this period of combustion that soot is deposited in the chimney and appears in quantity in the smoke, which now consists of tar vapour, soot, water vapour, products of combustion, and excess of air, together with the residual nitrogen from the portion of the air which has been used in the combustion and also particles of ash sucked up by the draught in the chim, ney. This is the second phase of the combustion.

As time passes on, the fire burns clear; the amount of flame becoming extremely small, and consisting chiefly of carbon monoxide, and practically smokeless combustion is attained. This constitutes the third phase, which continues until the fire needs replenishing, when the actions start afresh.

Let us try and see how far the actions taking place in the fire affect the amount of calorific value of the coal that is transferred to the room. A pound of coal of the composition we have been considering has a thermal value that may be expressed as 14,000 B.Th.U. When it is burnt in the open fire, it is practically only the radiant heat that is utilized, and measurements of the temperatures of the escaping products, heat imparted to the room and remaining in the ashes, &c., taken in conjunction with the heat value of the actions taking place and the heat lost in combustible matter escaping unburnt, give the following balance-sheet:

	B.Th.U.	
Heat used in decomposition and volatilization	1450	Lost 81 per cent.
Heat escaping in flue gases	6000	
Heat lost in unburnt matter escaping up chimney	3610	
Heat in ashes and grate	265	
Radiant heat imparted to room	2675	Used 19 per cent.

So that, in round figures, only one-fifth of the heat value of the coal is utilized. This means that, of the 35,000,000 tons of coal annually consumed as domestic fuel in this country, the heat actually utilized in warming our rooms represents only the heat value of 7,000,000 tons; the remainder being wasted in the flue gases and in producing the mixture of tar vapour, steam, soot, and ash that fouls our town atmospheres.

When coal of the same class undergoes destructive distillation at the gas-works, coal gas, tar, ammoniacal liquor, and coke are the result. We know the coke and coal gas are both easily burnt without smoke—the former because it contains no volatile hydrocarbons, the latter because the volatile hydrocarbons are of so simple a character that its smokeless combustion is obtained easily by any decent form of atmospheric burner; and it is clear that it must be the liquid products that are the culprits in smoke formation.

In the smoke as produced by the domestic fire the general tendency has been to consider the solid carbonaceous matter, greasy with some of the condensed hydrocarbons of the tar, and spoken of as soot, as the chief cause of the evil brought about by the smoke scourge. But though it has been proved by statisticians that the soot fall in London alone amounts to 70,000 tons per annum, the damage that it does is small as compared with the tar vapour. Soot settles readily from the air, and is washed down quickly by rain and, better still, by snow; so that, although its dirtying action is great, it does not do the amount of harm that is brought about by the cloud of floating vesicles of tar containing flue gases and vapours that enable them to survive until such time as rough impact with solid substances causes them to burst. It is the tar that glues the dirt to our buildings and stops the pores of animal and plant life, that causes the overhead cloud which cuts off the sun's rays and shortens the hours of vitalizing sunshine; it is the tar that coats the particles of water in a white mist and transforms it into a yellow fog that lasts until heavy rain or wind clears it away; it is tar that gives what we term the cumulative effect of smoke, which darkened the closing years of the last century.

Many have been the attempts to burn bituminous coals under conditions that would prevent the formation of the agglomeration known as smoke, and the failures have equalled them in number. Underfed stoves, in which the coal was fed to the bottom of the incandescent mass of fuel instead of on to the top, gave the greatest promise of success, as during the distillation phase the products were mostly decomposed in the hot fuel. But though re-invented many times since Arnott first gave the idea, the initial cost of their installation, and certain imperfections in working, have always led to eventual failure; and there is not the least doubt that if smoke is to be abolished it can be done only by abandoning the use of bituminous coal.

The fact that our gas-works supply two forms of fuel that are smokeless at once suggests that here we have ready to hand the means of supplanting a thoroughly unsuitable fuel and replacing it by others which not only give an enormously enhanced efficiency in the work required of them, but would solve the problem we all have at heart. Surely, but slowly, the gas-fire is replacing the coal-grate; and approximately one-sixth of the coal-fires in London have been replaced by gas, with the result that the registers show a gain of 84 hours a year in sunshine, and the yellow London fog has been improved out of knowledge, and much more resembles a country mist.

What, then, is it that prevents the gas industry completing the work they have begun so successfully? What are the barriers that must be swept away before the community at large can enjoy the inestimable boon of a clean atmosphere? The chief factors are the interests of the coal retailers, prejudice on the part of consumers, and last, but not least, that the gas industry has not yet realized the importance to them of becoming the sole suppliers of domestic fuel. The coal industry is keenly alive to the position. Experiments are proceeding in a dozen different directions to secure methods of making a solid smokeless fuel to take the place of coal, as the inroads that the use of gas as a fuel has made on the amount of coal consumed are already being felt by the retail trade; and the moment they can put a good smokeless fuel on the market without the aid of the gas companies in getting rid of the gas, they will do so, and one of the greatest chances the gas industry ever had of an enormous advance will be lost.

The prejudice still existing among a certain number of consumers against gas-fires, and the hundred and one operations to which coal gas as a fuel is pre-eminently adapted, had its inception in faults in the earlier forms of apparatus, and to the principles which must be applied in using gas for domestic purposes not being thoroughly understood. The early forms of geysers and water-heaters were made with the flame of the atmospheric burners impinging on the coils in which the water to be heated was circulating, and, oblivious of the fact that the checked combustion of the flame must give rise to carbon monoxide and other poisonous products, were fitted in bath rooms without flues to the apparatus or even proper ventilation to the room—the fatal accidents which resulted naturally giving rise to grave mistrust. Now that the cause of these troubles is realized, a gas-heated water supply to a house is recognized to be one of the most important factors in comfort.

In the same way, the older forms of gas-stove that gave only some 30 per cent. of the heat value of the gas as radiant heat, and relied for the heating efficiency on a hot-air chamber which gave a large amount of convected heat, so raised the temperature of the air as to render it unhealthy for breathing, while the hot air so increased the rate of evaporation from the inmates as to give severe physical discomfort. Now the modern gas-stove heats the room in the best possible way. Fifty per cent. of the heat given off is radiant heat, which warms the solids in the room and prevents chill; while about 12 per cent. of the heat is convected, and that from surfaces which are not overheated, with the result that the air is kept at a comfortable and healthy temperature that allows the normal body functions to proceed naturally, and no discomfort arises.

If we take a balance-sheet for the heat utilized by the gas-fire and compare it with the coal-fire, the results we obtain are—

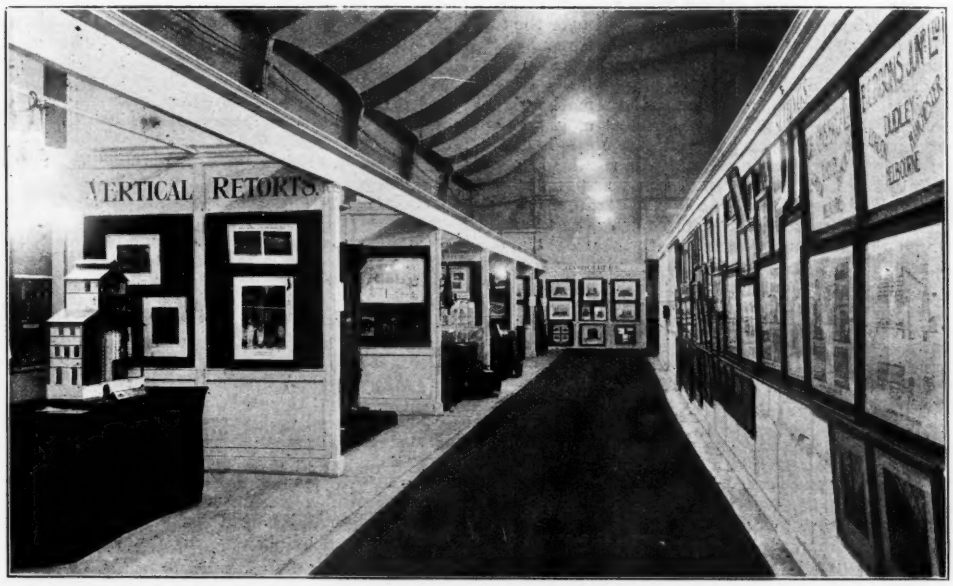
		Coal Per Cent.		Gas Per Cent.
Lost	Flue-gas losses	43	..	38
	Unburnt gases and vapours	26	..	nil
	Decomposition and volatilization	10	..	nil
	Heat in ashes and grate	2	..	nil
Used	Radiant heat	19	..	50
	Convected heat	nil	..	12

while I am assured that the newest development in the gas-stove, and which is one of those to be seen in the exhibition, gives no less than 71 per cent. of the heat of the gas as radiant heat.

The coal trade tries to impress upon consumers the fact that gas is more expensive than coal for continuous heating, and found their statement on a pound of coal containing 14,000 B.Th.U.; so that in buying a ton of coal for 25s. you obtain 31,360,000 B.Th.U., while with gas at 2s. 6d. per 1000 cubic feet you would get only one-sixth that amount. Only one-fifth, however, of the heat units in the coal are utilized in the domestic grate, and the enormously higher efficiency of the gas-stove reduces the difference in cost between coal and gas to a point at which the economies obtained by the use of gas far outweigh the slight extra expense.

The coal is delivered into the cellar, and handling, waste, cost of laying fires, trouble of attending to them, dirt, and grate cleaning are all factors which make the gas the cheaper fuel in the long run; while the fact of being able to turn the gas on when needed and off when done with, the perfect command of the temperature, the quiet burning and the absence of necessity for constant attention, extra safety and even heating, all give gas as a fuel an overwhelming advantage. Now that it is proved to be as hygienic for this purpose as the coal-fire, its advance in popularity will be rapid; and this is shown by the fact that any rise in the price of coal is reflected in the number of gas-stoves fitted. The last coal strike resulted in 80,000 gas stoves and cookers being installed in London during the following nine months.

It is clear, therefore, that prejudice is practically a thing of the



A NIGHT VIEW (AFTER THE CLOSING HOUR) IN THE PHOTOGRAPHS AND MODELS SECTION.

past; and the question that arises in one's mind is: Why should not the gas-fire displace the coal-grate entirely? The reason why any such advance would be an impossibility is that for gas to be a universal fuel, its price must be kept down. Increasing cost of coal and the labour conditions at present existing render this difficult, and further lowering in price almost impossible to hope for, unless some alteration in the method of carbonization is adopted. The limits of economical gas production are being rapidly approached; and to increase largely the output of gas, and to give any chance of reduction in price, a *pro rata* market must be made for the other products of destructive distillation. The liquid bye-products will look after themselves. You might treble the output of tar and liquor, and, under existing conditions, there would be an ever-improving market for them.

It is the coke that is the trouble. It is not hard enough for metallurgical or even generator work, and too hard and impure for a domestic fuel. Gas-works coke as at present made falls between the two stools. It never was, and never will be, a popular domestic fuel, as it is difficult to ignite, and for that reason gives a dull fire. A dull fire in turn means a poor chimney draught, and any failure in this respect means that the high sulphur content of the coke emits a smell in the room. Mix it with one-third its weight of coal, however, and it makes an excellent fuel, as the coal gas gives easy ignition and free burning while the flame ensures a good chimney draught. Such a mixture, however, is not perfectly smokeless, although a great advance on coal alone; and the fact that cellar space is needed to make the blend is against it in these days of flat dwellings.

Already over-production of gas coke is beginning to hamper some works, and what is really wanted to solve the smoke problem is that gas companies should remember that they are also coke companies, and supplement the magnificent work they are already doing by adopting some more elastic systems of carbonization, so that by chamber carbonization they might make a true hard coke for metallurgical work and power generators—thus increasing local markets in this direction. At the same time, they might adopt low-temperature carbonization to fill the domestic market with a soft coke containing 8 per cent. of volatile matter, using the small volume of rich gas, after stripping it for the production of motor spirit, with the poorer gas from the chambers. Some such method of working would increase profits from the enhanced value of the coke and liquid products; and I am convinced that it is on these lines that gas companies will solve the great question of the purification of our town air.

The CHAIRMAN proposed a vote of thanks to Professor Lewes for his brilliant and cheerful paper.

Mr. A. J. MARTIN seconded, and mentioned that he had been burning coal in his office for the past seven or eight years; but he had been so impressed by what he had heard of the exhibition that he had, on the previous day, telephoned to Mr. Goodenough, and had a gas-stove installed. Professor Lewes had referred to the barriers to be swept away before a clean atmosphere could be anticipated. But he had omitted one—namely, the price of gas; and perhaps in this connection attention might be given to the method of carbonization. If the gas industry were started afresh to-day, no doubt gas would be regarded primarily as a heating agent and not a lighting agent; and he trusted that some attention would be given to the possibility of producing a gas primarily for fuel, which would, however, also be available for lighting purposes at a considerably lower cost than illuminating gas to-day. He was well aware of the difficulties with which the gas companies had to contend—the ignorance and prejudice of consumers, and the lack of perception on the part of some public bodies; but he hoped that some of these difficulties would soon be overcome.

Mr. W. T. COX BRUTON said that, as the result of the meeting of the Coal Smoke Abatement Society two years ago, he had been so impressed with the necessity for a stove to burn coal smokelessly that he had set to work and devised one. The stove was fitted with a series of hollow bars connected with a hot-air chamber at the back. The stove also had hollow sides, from which

A NIGHT VIEW (AFTER THE CLOSING HOUR) IN PART OF THE STREET-LIGHTING SECTION.

tubes projected into the fire. The hot air passing through these tubes, and also the products of combustion, passed over the top and came into contact with the heated flame, which resulted in the whole of the products of combustion being consumed without the production of any smoke whatever.

Mr. J. L. CHAPMAN (Harrow), referring to the remarks which had been made as to the improbability of the cost of gas being reduced, assured the meeting that gas manufacturers had the possibility of reducing the price constantly in mind. If coke could be made available for fuel purposes in the poor man's cottage, leaving the lighting to be done by the gas, there would be every possibility of a reduction in the price of gas in the near future. The thanks of everybody were due to the Coal Smoke Abatement Society for the great work which they had done; and he congratulated the previous speaker on the production of the stove to which he had referred.

Mr. JACQUES ABADY (London) said he was absolutely convinced that, both from the hygienic and economic points of view, the householder could not have too much gas for all purposes. Coal should be abolished in every household. Bearing on the advantage or the disadvantage of burning coal in an open grate or burning gas, he would like to give a few figures he had. Professor Lewes had shown that only about 20 per cent. of the heat from coal was utilized in heating the room when burned in an open grate. Taking the Professor's figure of the heating power of coal at 14,000 B.Th.U.—he thought this was rather an overstatement, and should prefer to say that the class of coal used in a grate would be nearer 13,500 B.Th.U.—but assuming 14,000 heat units in a pound of coal, and 2240 lbs. in a ton, with 20 per cent. utilized it meant that from the ton of coal there were obtained 6,272,000 heat units. If a ton of coal were taken and converted into gas, it would be possible to obtain 12,000 cubic feet of gas of 500 B.Th.U. per cubic foot, and about 10 cwt. of coke. The 12,000 cubic feet of gas of 500 B.Th.U. would equal 6,000,000 heat units, or almost as much as was obtained from the coal. It was impossible to get the whole of the heat from the gas at the present moment; but assuming 62 per cent. of it was obtained—he believed that it would be 80 per cent. before long—62 per cent. of 6,000,000 was about 3¾ millions, in addition to which there was the heat contained in the 10 cwt. of coke. This coke would certainly have a heat value of 14,000 B.Th.U.; so that the 10 cwt. would contain about 15,000,000 heat units, and if only 44 per cent. of this were obtained, it gave an additional 7½ million units. So that by utilizing the coal in the form of gas for lighting and in the form of coke for heating, practically twice as much effective heat was obtained from the coal as if it were burned in an open fire.

Mr. F. W. GOODENOUGH, referring to the question of the price of gas, assured Professor Lewes that his anticipation of the improbability of any decrease was not shared by those who were responsible for the gas supply of London. It was hoped that when the present unfavourable condition of the coal and oil markets had yielded to the natural course of things there would be possibly further reductions in the price; and the question of whether the kind of gas to be supplied should be in any way altered so that, while keeping it as suitable for heating as at present, it would be more economical in production, was undoubtedly engaging the very serious attention of the responsible leaders of the gas industry. So also was, and had been, the question of the production of a solid fuel of a different character from ordinary coke produced from gas-works. So far, however, the economic balance had not been in favour of the smokeless fuel with more volatile constituents in it than ordinary gas-works coke. But there was one direction in which the gas industry had helped to solve the smoke problem of late years; and that was in the introduction of the penny-in-the-slot meter for enabling working people to use gas for cooking and heating in place of oil and coal. The gas industry had also of late years developed considerably the use of coke among the poorer classes, by supplying it in 28 lb. quantities (in brown paper bags) at 4d. or 4½d., according to the market price. This had led to a considerable increase in the use of coke instead of coal by the working classes in their kitchen and other grates, and was helping materially to solve the smoke problem, quite apart from the increasing use of gas generally. The London Gas Companies and others in the country were not oblivious of the fact that the word "coke" appeared in their titles; it formed a very substantial part of their business, and the gas industry was at the present time taking all the steps that were possible to increase the use of coke for those purposes for which it could with advantage be employed in place of coal. Therefore, Professor Lewes had hardly given the industry credit for the amount of attention it was paying to this side of the business.

When the conference re-assembled after lunch, Dr. H. A. DES VOEUX took the chair, and expressed regret at the unavoidable absence of Sir William Richmond. Under the circumstances, Mr. L. W. Chubb, the Secretary of the Coal Smoke Abatement Society, read Sir William Richmond's paper.

PROPOSED TAX ON SMOKE.

A paper entitled "A Curse of Civilization," prepared for the conference by Sir WILLIAM RICHMOND, R.A., was read, in his absence, by Mr. L. Chubb, the Secretary of the Coal Smoke Abatement Society. The "curse" referred to is, of course, coal smoke, which the author characterized as "perhaps the greatest evil, outside what is positively wicked, that modern civilization has created." He said "created," which was true; but he ought to have said much more—"encouraged." The evil was due to carelessness in one respect, apathy in another, and he was afraid, if he told the truth, he must say selfishness in yet another; for did not manufacturers live under the smoke which their shafts emitted? Having enumerated the evils arising from the effects of smoke, which are perfectly well known, the author said there was no excuse whatever either for sluggish legislation or for inactivity on the part of borough and county councillors to cope with so serious a nuisance. It was quite true that household chimneys give off a great deal of smoke; but at present, as the law stands, they cannot be dealt with. Possibly the use of gas fires and stoves for heating and cooking purposes within a measure lessens the evil. But legislation could deal with factories, and it had done so in an ineffective manner. There was no doubt that London was less often overwhelmed by black fog than formerly. Since the Coal Smoke Abatement Society set seriously to work, there had been improvement, but, unfortunately, not so much as should have taken place. He would put a tax on smoke. He would say to manufacturers: "If you tell me that smoke is necessary for your business"—which statement everybody knew was an inaccurate one, smoke being a serious and very expensive nuisance—"you must pay for its presence." If factory owners were taxed £1 a day until all smoke had disappeared from their shafts, he would not mind making a big bet that in a year's time there would be no more smoke from factories in England. When men found that they had to pay a tax of £300 a year, which was equivalent to a large rent, perhaps they might do so for one year, but he questioned whether they would do it for two years. If they were told by a strong Government that what they made would be taxed, and to a point which would interfere with profit, they would soon find means to avoid the tax by a diminution of the thing taxed—that was to say, they would immediately either apply remedies against making smoke which were already in the market or would invent new ones. The abolition of smoke from all factories would cost the Government nothing. It might for the moment cost companies and individuals something; but this cost would soon be covered through the saving of coal by consuming all of it, instead of allowing a considerable proportion to be wasted. If this conference meant business, and was not to result only in talk, it would, after thrashing out ways and means to abolish the scourge of coal smoke, put the ideas together in a short, decisive form, and forward a statement to the Government, to the London County Council, and to all the borough and county councils.

WORK OF THE COAL SMOKE ABATEMENT SOCIETY.

Dr. H. A. DES VOEUX, the Hon. Treasurer of the Coal Smoke Abatement Society, submitted a long paper entitled "What the Coal Smoke Abatement Society Has Done and What it Could Do." He explained that the Society was started in 1899, by Sir William Richmond, and throughout its somewhat troubled existence had laboured continuously to educate the public on the smoke question. They recognized at once that smoke existed not from any wilful desire to hurt, but from ignorance of the methods of preventing it, and that there was a want of some point from which any who wished to rid the country of this evil could start together on a long and uphill fight. Their programme was short, practical, and comprehensive. The Society's objects were:

1.—To aid in enforcing, through the local sanitary authorities, the existing law dealing with smoke nuisance which is contained in the Public Health (London) Act, 1891, and the Public Health Act, 1875.
2.—To promote and encourage all voluntary efforts to abolish smoke from dwelling-houses, and to inquire into the best means of effecting this object.
3.—To obtain particulars and evidence of the methods of dealing with smoke nuisances at home and abroad.
4.—To publish information on matters relating to smoke nuisances and the methods by which they may be abated, and for this purpose to encourage the organization of exhibitions and stimulate invention by the offer of prizes.
5.—To bring about the amendment of the present law where it is not efficient.

The only immediate result the Society could expect to attain was that they should induce the Borough Councils of London to start the work which the Act of 1891 imposed upon them. By this Act it was made incumbent upon sanitary authorities to serve statutory notices on the owners of all factory and other premises (not being domestic) from the chimneys of which smoke issued in such quantities as to be a nuisance. Another part of their aim had been to find out by what means the enormous amount of smoke which was caused by the coal-fire could be diminished. They carried out two or three series of tests of grates recommended as smoke consuming, and although the efficiency of some was greater than that of others, and although economy had been increased and smoke diminished, he felt quite sure he was on safe ground in asserting that a smokeless atmosphere could never be attained with the the burning of bituminous coal in any kind of open grate. This might at once and for ever be dismissed from the mind. What was wanted was a solid smokeless fuel capable of being burnt in the open grates already fitted in every house. He was sorry to say that in this matter of the utmost importance they were unable to enlist, he would not say

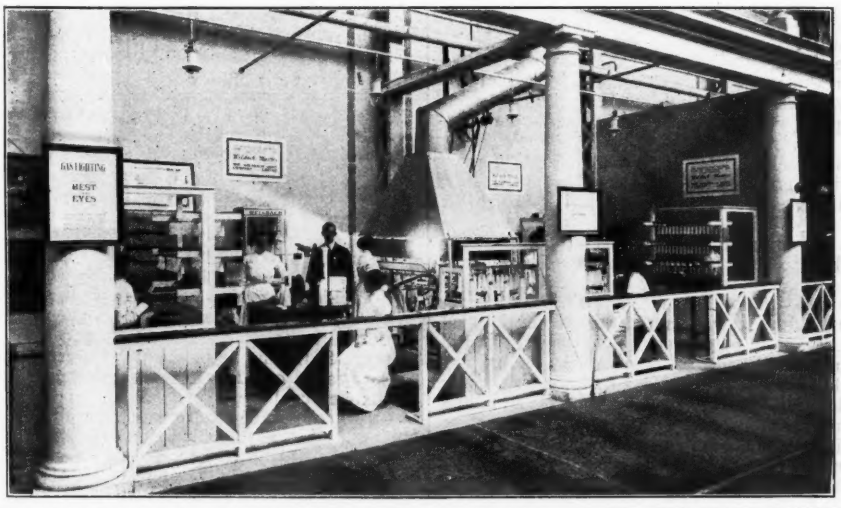
the sympathy, but the assistance they expected from the gas companies. However inventors had done, and were still doing, much. "Coalite" was the first, and when well made, was a fine fuel. It failed, he thought more from financial reasons than from the fault of the fuel, for which there was a large and increasing demand. Other fuels of a similar kind had been made, but were almost unattainable; but there had been placed on the market one with which the Society could experiment during the coming winter—viz., "tarless fuel;" and if what was being made now was equal to the sample he tried two years ago, he promised it a great future. There would be an immense demand for solid smokeless fuel; and if it could be produced on a paying basis, efforts ought to be made to push it as much as possible. In his opinion, it was the duty of gas companies to work to this end, and to look a little into the future—to become not only hard financial concerns, but to allow their strictly business attitude to be tinged with a slight philanthropic zeal. When once they had a solid smokeless fuel, the day of daylight was at hand. What nobler work could be done for the country!

Having said so much that was critical because the subject was so all important and so dear to his heart, the author turned to what the gas companies had done for the Society. His hearers would recall what he said about gas-stoves in 1899. What could or need he say of them now? There were more than a million of the different forms of them in use to-day; and they had contributed as much towards increased light and cleanliness as the cessation of smoke from factory chimneys. Every additional gas-fire helped. It diminished the amount of smoke and dirt, and it made the user a well-wisher to the Society's crusade. Continuing, Dr. Des Voeux said:

I think it would be an insult to the intelligence of my audience if I were to say much in favour of gas-fires; the facts are so well-known nowadays. All that is required is to state briefly that in my early professional career, owing to their then insanitary working, I was led times without number to condemn, and cause the removal of, gas-fires from bedrooms; whereas my experience of modern gas-fires has proved that the grounds that then existed for this judgment have now entirely been removed by improvements in construction, workmanship, fitting, and design, so that I now am able to take up the opposite attitude, and strongly recommend them in cases of long illness. . . . I feel certain that the use of gas will rapidly increase; for such is the talent of those at present at the head of our leading companies, such is their power of "push" that you can seldom take up a newspaper, travel in the underground or public conveyance, without having some attractive virtue of gas impressed on your mind. They are fine advertisers, these gas people; and their fortunes are safely left in their own hands. If they would only listen to my appeal, I could sanctify them, and I believe the world would. St. Daylight and Coke Company would be an improvement on the present name. In my own house, all food has been cooked by gas for eighteen years, and most of the sitting and bed rooms are heated by gas.

After the gas companies, continued the author, came the electricity companies, who were slowly, but surely, pushing their way into prominence as suppliers of heat. Electric heaters, however, had a grave fault, which it was useless to hide, and that was a want of ventilating power. Electric cooking, on the other hand, had no disadvantages of this sort, and was steadily advancing in favour. In regard to central heating, the idea of it was foreign to British minds; but no doubt it had many advantages.

In conclusion, Dr. Des Voeux said the Society had attended conferences, talked much, written much, given advice, freely and gratis, and gradually ventilated the subject when and where opportunity offered; and they had taken direct part in three or four exhibitions. He hoped he had been able to prove that, small as the Society was, it was certainly a live body, and one that had led, so far, a useful existence. The work had been taken up in other places—in Glasgow more particularly—in Birmingham, Leeds, Manchester, Sheffield, and many other leading towns. On the Continent, Germany was in the van; and they had had some



THE MANTLE-MAKING STAND, WHILE IN THE OCCUPATION OF THE WELSBACH COMPANY.

correspondence on the subject of smoke abatement with France, Austria, Italy, Turkey, and Sweden. India was working at it; and the Americans were doing much. They had started a ball which would continue to roll; and, so far as the mind's eye could see, nothing could now stop the movement. The only danger was want of money; and he appealed for help in a career which he said was as unselfish as it was beneficent, and which would, if its object were once attained, add immensely to the health of town dwellers, to the beauty of towns, and to the amenities of both public and private life.

Dr. S. RIDEAL, in proposing a vote of thanks to the two authors, referred to a conversation he had had, just before the meeting, with the Right Hon. John Burns, the President of the Local Government Board, who had informed him that he was keenly alive to the importance of this problem. It was evident that only by those interested continuing to urge the necessity of reform upon the Government would any progress in the desired direction be made. But some satisfaction was to be obtained from the knowledge that the present President of the Local Government Board was in favour of the movement. He emphasized the necessity, pointed out in the paper, of removing the word "black" from the Public Health Act, and the bringing of domestic chimneys within the Act as well as factories, and, further, suggested that no factories should be allowed to emit into the air sulphuric acid from their chimneys—his suggestion being that all factories should be brought within the terms of the Alkali Works Act, which at present made it an offence for alkali and chemical works to emit sulphuric acid from their chimneys.

Mr. MAURICE HULBERT seconded, and expressed the opinion that, after the good work done by the Coal Smoke Abatement Society, it was inexplicable that larger funds were not obtainable for it. Perhaps the formation of branch societies in the larger towns—such as Liverpool, Manchester, and Bristol—would help towards this end. A great deal had been said about Government action; but Government action was largely dependent on what was known generally as political action, which was dependent on what was known as party political action. And one reason why a Government could not do as much as it might be willing to do was that Parliament was choked with work. The only gratitude one could feel towards the Government in this matter was that Government buildings had been loaned for testing grates from time to time. Similarly, more might be done by the Press of the country, which, probably quite naturally, gave greater space to things which helped to sell the papers more than did the question of smoke abatement. It was quite clear that a great deal remained to be done, although the present exhibition would help largely to popularize gas for all purposes.

Mr. F. W. GOODENOUGH said he would not follow Dr. Des Voeux into a discussion of the relative merits of gas and other competitive systems of heating, as he did not think it would be becoming for one so closely identified with the gas industry as he was to occupy an independent platform in a controversial advocacy of gas in comparison with anything else. He would like to add his tribute to the unselfish work of Dr. Des Voeux for many years in connection with the Coal Smoke Abatement Society—a work which those unacquainted with it could not realize. With regard to the President of the Local Government Board, he had the pleasure of showing him round the exhibition a few evenings ago, and the right hon. gentleman had then stated that the question of smoke abatement and the use of gas in connection with it was the aspect in which he was most particularly interested, and that he felt much good would result from the congress and exhibition. He (Mr. Goodenough) would also like to offer a word of thanks to the Press for the amount of space they gave to this subject.

Mr. A. J. MARTIN expressed the opinion that the lack of support

of the Coal Smoke Abatement Society was rather due to its light being hidden under a bushel. As an instance of this, he mentioned that some friends of his who were interested in the subject had, until a few days ago, not heard of the Society. He thought that an improvement in the atmospheric conditions of large towns by the prevention of smoke would improve largely the temper of the workpeople, and reduce, if not prevent, the number of labour troubles which now existed. Referring to the suggestion that persons allowing smoke to be discharged into the atmosphere should be taxed, he said he thought the better plan would be to adopt a differential system of rating, which would benefit those persons who abandoned the use of coal altogether. He concluded by proposing the following resolution :—

> That this conference desires to place on record its conviction that the time has arrived when, in the interests of the health and the well-being of the community, the cause of smoke abatement should form the subject of immediate Government inquiry and action, with a view to the alteration of the law under which smoke nuisances of all kinds are now possible, and that a copy of this resolution be forwarded to every Member of both Houses of Parliament, and to all county borough and municipal authorities in the country.

Professor Vivian B. Lewes said that Dr. Des Voeux had put forward a very strong plea that gas companies should, if possible, be a little more elastic in their methods of carbonization. He agreed with this, while at the same time giving the gas companies credit for having done magnificent work during the past twenty years. What was wanted was the production of a better and an easier-burning coke—more on the lines of coalite. He had had a great deal to do with coalite, and knew every step in its history; and there was not the faintest doubt that if a fuel like this could be put upon the market, the reception which awaited it was one of the warmest that could be given to anything. The demand for such a fuel would be an enormous one. If the gas companies could see their way to bring in such methods of carbonization as would enable the supply of a domestic fuel of this sort in addition to a gaseous fuel, they would have practically the whole of the fuel supply of the world in their hands. There was no doubt that the fuel supply of the country was gradually diminishing, and the present tendency for the price of coal to increase he did not believe was a temporary effect at all, but was in reality the beginning of a rise in the price which in time would threaten our commercial supremacy. Mr. Abady's point upon his (Professor Lewes's) paper was an excellent one—namely, that by taking the efficiency of the various portions of coal, after it was distilled, and comparing it with the efficiency of the coal itself, a result was obtained which showed in a very striking way indeed the wicked extravagance of burning bituminous coal in fires. From coal gas something like 50 per cent. of radiant efficiency could be obtained in a gas-fire, while from the coke another 40 per cent. could be obtained—giving an efficiency of the two together of 90 per cent. of what was in the original coal, compared with somewhere about 19 per cent. efficiency from the coal when burned in an open fire. There was no doubt that all coal ought to go through a process of distillation before it was sent out to the public; but those who took upon themselves the onus of distilling it, must also legislate for the users. They must supply to the domestic hearth a softer form of coke. He did not wish for one moment to put forward the plea that gas-works should at once do this. He did not mind saying that the production of a smokeless fuel had bulked largely in their talk for the last seven years; but there was no one at present who knew how to commercially make a really soft coke. Coalite was, from its inception, one of the grandest ideas ever brought forward, and some day or other was absolutely certain to make its mark in the world, although probably under some other name. Coalite was the right thing; but the right way of doing it was still to be found. There were at present workers in every part of the kingdom investigating this matter. In Glasgow, Dr. Beilby was trying to carbonize coal in such a way as to give a good smokeless fuel; in Battersea, there was the Tarless Fuel Syndicate working on the same problem of low temperatures in high vacuum; and in Burton, work was being carried on at high temperature and with medium vacuum. Efforts of the same kind were being made in other parts of the world; and some of the workers would undoubtedly find a method by which smokeless fuel could be obtained, which would not only be all that coalite was, but would also be strong enough to be handled, because that was practically the weak point in the present smokeless fuels. In the manufacture of coke there were three distinct stages: First, the coking coal became practically semi-liquid, which was followed by the swelling stage, and, lastly, owing to the long continuance of the high temperature, the material shrank, and hard coke was the result. With soft coke containing 8 to 10 per cent. of volatile matter, a cheerful fire could be obtained. Such a fuel was provided at the second stage, when it had not yet undergone the hardening effect of the final shrinkage; and this was where the trouble came in, because it was so friable that there was from 20 to 30 per cent. loss in handling. Gas companies had their commercial side; and the difficulty of making a good smokeless fuel was the real factor which had prevented gas companies taking it up. Give the gas companies a good method by which they could make a really sound commercial thing, and it would be found that they were wide awake enough in their own interests to take the matter up. Referring to the question of gas-stoves, he thought the statement in Dr. Des Voeux's paper, that there were over one million in use at the present time, might be extended to probably 1,700,000. On the question of anthracite stoves, which were also mentioned in the paper as being a form of heating which was smokeless, and which might be used with advantage to a greater extent, it was probably well known that in America the anthracite stove was used to an enormous extent. He did not, however, want the Coal Smoke Abatement Society of England to fall into any such mistake. The anthracite stove was a closed stove in which anthracite coal—a very hard form of fuel—was burned in a smokeless form; the fuel being burned slowly, and the heat being imparted to the air of the room from the heated stove. It was true that smokeless combustion was obtained, and that heat was given off; but it was heat of the wrong kind. With an anthracite stove, the air came into contact with it and formed an up-current through the room, heating the air. It did not heat the solids in the room; and before the occupants of the room acquired a feeling of comfortable warmth, the temperature had to be up to an altogether unhygienic heat. If, on the other hand, one entered a room heated by radiant heat, the heat rays struck the person and the other solids in the room and warmed them, leaving the air perfectly cool for breathing, which was what was wanted. [Professor Lewes dealt at some length upon this aspect of the modern gas-stove, repeating the arguments he put forward in his third lecture on "The Evolution of Gas Lighting and Heating," see p. 125 of this issue.] In the modern gas-stove, they had now got to the point where over 50 per cent. of the heat was given off as radiant heat, and where the convected heat was cut down to a very low point indeed, with the result that the general consensus of opinion now was that the gas-stove was far more hygienic even than the open fire. Dr. Des Voeux's statement that 50 to 70 per cent. was lost with a gas-fire compared with a coal-fire, from the point of view of ventilating effect, was absolutely wrong both in statement and in fact. One of the great troubles which the gas-stove manufacturer had to contend with was that the draught in the chimney when a gas-stove was placed in front of an ordinary grate was so strong that too much air was drawn in for the incandescent fuel, and to a certain extent this lowered its radiating efficiency. One of the greatest secrets in the modern gas-fire was the regulation of the size of the outlet into the flue, and the exact position of the canopy which came over the incandescent fuel in order to prevent any products being sent out into the room itself. This was now done to a nicety, with the result that a strong up-rush of heat was secured for the gases. The right way, in his opinion, to fit a gas-stove was to have the back level with the arch of the open fireplace, and to fill the space around it entirely with glazed tiles, and round the whole of the stove, one or two tiles away from it, perforated tiles should be placed. These perforated tiles should open into an iron box at the bottom of the grate space, and just above the point where the flue gases came out with considerable friction. By placing what was practically a sheet-iron Venturi tube, it was possible to suck in through these perforated bricks even more air than could be sent in with the old open coal-fire; and this gave a much greater chance of bringing fresh air into the room. It was in this way that a gas-fire could be made every bit as good a ventilating agent as an open coal-fire.

Mr. Jacques Abady expressed the opinion that, in spite of all the hard work, of the eloquence, and many years of publicity in connection with the Coal Smoke Abatement Society, the result of the efforts of the Society was admittedly practically *nil*. [Cries of "No, no".] He did not say this in any spirit of criticism; but the fact remained that the result of the work of the Society was lost in the ocean of smoke at present existing. [Further cries of "No no."] At the same time, he agreed that the Society were doing good work, although he repeated the opinion that the results of this, from the point of view of saving the world from black smoke, were practically negligible; and he thought this opinion was borne out by the language which both Sir William Richmond and Dr. Des Voeux had used. The question he wished to ask was: "What caused smoke?" He did not think anybody in the room had really critically analyzed and got down to the bed-rock cause of smoke; and he suggested that the answer to his question was "the open combustion of coal as compared to its closed distillation." When coal was burned in an open grate, it was true that there was a process of distillation going on, and that the volatile matters came off. It was really a process of open combustion. When, on the other hand, gas was being made, coal was put through a process of closed distillation; and the question of the formation of smoke depended entirely on whether the coal went through this process of closed distillation or open combustion. If his proposition were true, it followed that there was only one scientific way of utilizing coal, and that was to turn it into gas, and to use it either as gas or electricity The relative merits of the two forms he left to the protagonists of the Press; but it should be the aim of the Coal Smoke Abatement Society to urge forward the view, and ram it down the throats of everybody, that there is only one scientific, sanitary method of turning coal into other forms in which it should be utilized, and that was by the process of closed distillation. When he talked about gas making, he did not mean the process now going on in an ordinary gas-works, where the idea was to make so many feet of gas and so many hundredweight of coke from every ton of coal. It was, of course, possible to make thousands of cubic feet of gas from the coke afterwards, if it were wanted. There was always an outlet for making gas of suitable quality which did not seem to be borne in mind—namely, at the pit mouth, where the coal could be coked, and gas produced as a

secondary product. The point he was now on, however, was that the present process of generating electricity by means of coal burned in boilers containing water, which was turned into steam, was, from a primary point of view, one of the most wasteful and unscientific processes that could possibly be imagined. If those responsible for the conduct of the gas industry were to meet those responsible for the electrical industry, he was certain that within a decade or two they would have electricity generated in millions more units than at present from coal that had not been subjected to a process of open combustion, but to a process of gas-making by closed distillation. This, of course, it was quite obvious, would abolish all smoke, because no one would use any light, heat, or power which could raise smoke, inasmuch as no smoke would be raised at the gas-works. Further than this, by the present methods of open combustion, more of the available bye-products, such as ammonia, dye stuffs, acids, oils, motor spirit, &c., was lost and never recovered in the way possible by closed distillation.

Mrs. M. A. Cloudesley Brereton expressed her gratitude, as one of those responsible for the organization of the programme of conferences and lectures in connection with the exhibition, for the great interest and personal attention shown by the readers of the papers and others who did so purely from the point of view of the public welfare, and not because they had any particular axe to grind, or any interest in the gas industry. All the work that was being done at the exhibition, and in which distinguished doctors, educationists, and legislators were taking part, was one portion of a great public campaign in this and all other countries of preventive medicine.

Mr. Thomas Marsh (Manchester) said he believed the Smoke Abatement Societies had done very great services to the country, and that Mr. Abady scarcely intended what he had said. Most probably the point which Mr. Abady intended to bring out was that possibly, taken in other directions, the work done in connection with the Coal Smoke Abatement Society would have produced much better results. The greatest possible credit was due to Sir William Richmond and Dr. Des Voeux for the manner in which they had organized and carried on the Coal Smoke Abatement Society against great odds. The best investment for any manufacturer was to closely investigate the question of smoke as it affected his works, because it was undoubtedly an economy to do away with it. At the same time, he did not think very much could now be said against manufacturers, who were doing their very best to reduce the smoke nuisance. The great difficulty was the domestic chimney. He himself now used gas-fires considerably; but in the early days he had been troubled very much with difficulties from want of ventilation. But by putting ventilators into the flue some 18 inches from the ceiling, he was able to get rid of the contaminated air in the room.

The Chairman then put to the meeting Mr. Martin's resolution, already given, and it was carried unanimously.

THE MANTLE-MAKING STAND NOW TENANTED BY MESSRS. CURTIS'S AND HARVEY (IRONCLAD MANTLES).

CONFERENCE OF EDUCATIONISTS.

A Conference of Educationists was held on Saturday, under the chairmanship of Sir George Kekewich.

Mr. F. W. Goodenough offered a welcome to Sir George and likewise to the readers of the papers—Professor Silvanus P. Thompson, F.R.S., Miss Mildred Atkinson, and Mr. Dow (who was present on behalf of Mr. Gaster, who had had to leave town), and Messrs. Septimus Warwick and Austen Hall. The presence of Sir George Kekewich, he said, was another of the many examples of his broadmindedness in connection with everything that had to do with education; and he wished to say, on behalf of the Executive Committee, that this conference had been called for the purpose of giving information, as far as possible, to those interested in education in this country. As to the service gas might be able to perform in the equipment and carrying on of educational establishments, it was not desired to use that conference in any way as a party platform on behalf of gas against any of its competitors. It was only desired to state the case for gas, and leave the case to be considered on its merits by those who had the final judgment in the matter. It was not thought that there would have been any justification for asking a man like Sir George Kekewich to preside, or a man like Professor Thompson to read a paper, if the meeting was to be used for the purpose of fighting the adversaries of gas. That could be done at other times and in other places. On this occasion, it was the desire to place before the public impartial evidence.

Sir George Kekewich, addressing the meeting, referred to the gradual development in the science of school building and equipment, and recalled many instances of school lighting and ventilation which he described as disgraceful. For natural lighting, he recommended placing the tops of the window-frames right up to the roof, as this not only gave better illumination, but afforded a much more efficient means of ventilation. With regard to artificial illumination, he laid it down as absolutely necessary that anything approaching to brilliancy should be avoided; and, in this connection, the use of clear glass globes was an extreme mistake. He believed that gas companies were fully alive to this. As regarded heating, he confessed himself old-fashioned enough to prefer a coal-fire; and he disliked radiators completely. At the same time, no matter what was the heating agent employed, there should be a chimney in every room.

SOME CONSIDERATIONS ON THE BRIGHTNESS OF LIGHTS.

Professor Silvanus P. Thompson, F.R S., then read his paper, in the course of which he said that, in spite of all the efforts of the men who have been studying and proclaiming the laws of illumination, there is a vast amount of ignorance still to be cleared away on the subject of good lighting. The observations he offered dealt only with artificial lighting, not with daylight. They were not confined to any one illuminating agent, but dealt with the subject broadly, since the laws of photometry are equally applicable to lighting by candles, oil, gas, electricity, or acetylene.

The bare statement of the candle power of a source gives no information upon another matter—viz., as to the illumination which the source produces upon a given surface, such as a writing-table or a wall. This illumination depends upon the distance of the source as well as upon its intensity. If the source be itself of small dimensions as compared with its distance from the surface, the numerical value of the illumination received by the surface may be calculated by dividing the numerical intensity of the source by the square of the number of feet that the source is distant from the surface (here assumed to be orthogonally normal to the direction of the light). The unit of illumination is therefore the amount of illumination afforded by one standard candle at a distance of one foot, and is commonly called one candle-foot (or sometimes one foot-candle). As an example of the calculation of illumination, we may give the case of a surface illuminated by a source of 100-candle power set 5 feet away. Dividing 100 by 5 times 5, we get as the answer that the illumination received is of the value of 4 candle-feet or four times as high as would be produced by 1 candle 1 foot away.

Too great emphasis cannot be thrown upon the practical importance of being able to ascertain (whether directly by measurement with suitable instruments, or indirectly by calculation) the actual illuminations produced in various places. In a school, for

example, the one thing that is most important to know is whether there is sufficient illumination afforded at the places where the scholars read and write, and at the place where the teacher writes on the black board. In public streets and squares, likewise, the real question for town councillors, for members of lighting committees, and for borough surveyors, as well as for the public, is this: Do the roads and pavements receive an adequate illumination? If they do, it matters not in the least, save as to the economic arrangement (which is a question of pure engineering), what the candle power of the lamps may be, or what the nature of the illuminant. If the desired result—adequate illumination—is obtained, the consideration of the means whereby it has been obtained is a secondary question. Due illumination is an end to be attained; candle power is a means of obtaining it. Whether this due illumination is better attained by a few lamps of great candle power or by a larger number of lesser candle power depends on the particular circumstances of the case.

But there is another point in respect of which the mere statement of the candle power of a source gives no information—viz., the question of its intrinsic brightness, or luminosity. Suppose two lamps to be of equal candle power—say, a 10-candle electric fairy lamp, and the other an old flat batswing gas-burner giving a 10-candle light. Viewed from a distance of four or five yards, one appears a brilliant point of light, the other an object of appreciable size much less brilliant in itself. One will seem to cut the eyes much more than the other, though both produce equal illumination at the same distance. They will not seem equally bright or brilliant. The reason is that the images these lamps produce (at the same distance) on the retina of the eye are not of the same size. The image of the smaller lamp is correspondingly smaller than the image of the larger flame; and as equal amounts of actual light are received in the two images, one will be more concentrated than the other, and the nerve structures of the retina will be differently stimulated. There will be a strong stimulation by one lamp over a small patch of the retina, and a weaker stimulation by the other source over a larger patch of the retina. The eye, in fact, is physiologically disabled from being able to equate together two equally powerful lights if the concentration of their respective intrinsic luminosities is different. At the best, the human eye is a very bad photometer. Its automatic adjustment, which closes the pupil in the presence of a flood of light and opens it in twilight—a most invaluable provision of Nature—works against it as a measuring instrument. And Fechner's law of psycho-physiology concerning the numerical relation between a stimulus and its resultant sensation shows, once and for all, the impossibility of setting up the eye as a judge of photometric values. The one and only thing that the eye can do in this regard—and it is the principle of every photometer—is to draw a judgment as to the equality or non-equality of the illuminations on two adjacent patches of space in the field of vision.

This question of the intrinsic luminosity or brightness of lights has scarcely received the amount of attention it deserves. It is this which makes a naked or unobscured electric glow lamp so unendurable to the gaze. It is this which leads people to put semi-opaque globes or shades round lamps to "diffuse" the light—that is, to make it seem to emanate, as it were, from a larger object; since if thus diffused or spaced out it no longer cuts the eyes, the retinal image being larger and less concentrated. But opal globes and ground glass shades, to say nothing of devices of paper or silk, waste an unconscionable percentage of the light. Modern dioptric globes are far less wasteful; they spread the visible outline of the source, but with a minimum waste by absorption. The intrinsic brightness of different kinds of luminous sources is expressed scientifically in terms of candle power emitted per square inch of area.

The higher the intrinsic brilliancy, the more unendurable is the brightness of any source. We know how blinding—how dangerous, in fact—it is to look directly at the sun. It appears to us as a round disc of the same apparent size as a threepenny-piece held at arm's length, glowing with light estimated at 200,000 candles concentrated in that small circle. But if we could diffuse it out to forty times its apparent diameter, and thus spread its light over an apparent area 1600 times as great, its apparent brightness would come down to only 125 candles per square inch. The bedazzlement of the eye by lights which are highly concentrated is a very undesirable result; it reduces the power of the eye to see clearly other objects that may be within the same field of view. There are a number of kindred phenomena which result in interference with perfect or comfortable vision. A light that is too bright, whether concentrated or not, dazzles the eyes, and causes discomfort in vision. Very smooth paper acts partly as a mirror, and reflects too much light at particular angles, interfering with the ability to see what is printed or written on it. Engineers give the generic name of "glare" to all these effects, and they strive to avoid all causes of it in their attempts to attain good lighting.

Another phenomenon which affects ease of vision is that of irradiation. In consequence of the imperfections of the lenses of the human eye, a bright point is never perfectly focussed on the retina as a point, but its image is a more or less blurred patch. A bright line is never focussed as a line of the proper width, but is always seen broader than it ought to be. A bright defined area, such as a white circle or a white square on a black background, appears to be of larger size than it is, owing to this defect of focussing, which makes the bright surface appear to encroach on its background. The converse happens with black dots, black lines, and black areas on white grounds. Black lines on white grounds always appear thinner than they really are; the light encroaches on the dark. This is the justification for using white chalk on blackboards, instead of employing charcoal on whitened boards. The phenomenon also affects printed type. Types designed with thin vertical strokes are less legible than those with thicker, since they are printed in black on white. The reverse would be the case if things were printed in white on black. The makers of public advertising plaques and of illuminated signs know this, as shown by their preference for white or pale yellow lettering on black or dark blue grounds. The relative invisibility of thin black lines on white grounds is enhanced if the white background is very bright. This is one reason why printed matter on a shiny paper is so bad to read.

The good lighting of a room depends not only on the disposition of the lights so as to produce an adequate illumination, and on the proper shielding of the lamps so as to avoid needless glare, but on the nature of the wall-surface on which the light falls. Even when the illumination that is received by the walls is ample, the room may be badly lit, if the walls absorb too much of that illumination instead of giving it back by diffuse reflection. Few people are aware (what illuminating engineers know) how much light is thus wasted and thrown away. White cartridge paper absorbs and wastes about 20 per cent. of the light; a white-washed wall absorbs from 30 to 40 per cent.; an ordinary yellow or buff wall paper usually wastes 50 to 60 per cent.; the deep scarlet and crimson wall papers now fashionable for dining-rooms waste from 70 to 75 per cent.; brown paper wastes from 85 to 88 per cent. Clearly, for economy in artificial lighting, and for comfort in the daylight lighting of large rooms, the ceilings should be invariably white; and the walls, if not white, should be of the palest tints.

During the last two years, the Illuminating Engineering Society have had valuable reports prepared for them by three Special Committees—one on Street Lighting, one on Library Lighting, and a third on School Lighting. I will speak only of the last. They recommend that for ordinary work in reading and writing the minimum illumination at any desk should be not less than 2 candle-feet; some members of the Committee favouring a minimum of 2½ candle-feet. For special work, such as drawing, stitching, and the like, the minimum recommended is 4 foot-candles. For blackboard illumination, 2 candle-feet is admitted to be sufficient only for small class-rooms, where the students are within 20 feet. The lamps for lighting the blackboard should be screened from the eyes to prevent glare. The Committee lay some stress on the use in general of shades or globes which diffuse the apparent brightness of the source over a considerable area, so as to reduce what I have called the bedazzlement caused by lights that are too concentrated. It goes without saying that the Committee favour the use of indirect lighting, in which the rays of the lamps are intercepted and thrown upon ceiling or walls only, so that a soft diffused light alone reaches the eye. The disadvantage of this method is that it is almost shadowless. For reading and writing, this is good; but the visibility of solid objects and raised surfaces greatly depends upon the presence of shadows, and for this a direct illumination is preferable. All school managers and school architects would do well to study the recommendations of this Committee.

THE PHYSIOLOGICAL AND MENTAL DISADVANTAGES OF UNSCIENTIFIC ILLUMINATION.

Mr. J. S. Dow followed with Mr. Gaster's paper on this subject.

The author said that good lighting is of vital importance to the adult in his daily occupation, but still more so to the child at school, or even in the nursery. It is, therefore, the duty of parents to see that any reading or fine work undertaken by the children during the evening is not done in gloomy, ill-lighted corners of the room. But while reading at home is optional, study at school is compulsory. How much greater, therefore, is the responsibility of school authorities to see that the school-rooms are well lighted! Medical authorities tell us that a progressive deterioration in eyesight occurs during school life. We can readily understand why this should be the case. For a child working by insufficient light instinctively tries to bring the book nearer to his eye, or bends so as to bring his eyes nearer the work. This constant close vision is believed to be one of the main causes of short sight. Moreover, the habit of assuming a stooping attitude is bad for the figure of the child.

Habitual work in a poor light, besides being prejudicial to the eyes, may be detrimental to the general nervous system, for it increases the strain of work at a critical period in the child's development. Then, again, a child who is short-sighted loses much of what goes on around him, and is often put down as stupid or inattentive. Thus poor lighting, by causing defective vision and impairing one of the channels by which information is received, also prejudices the brain development, and may interfere seriously with a child's education.

There is one other strong argument that may be brought forward on behalf of good lighting in the schools. The illumination should be good for the same reason that the school-room should be cheerful and clean—because it serves as an example to the children. If they find in the school-room makeshift and antiquated methods of lighting, they go out into life with a low standard in this respect, and so the evil is perpetuated. If, on the other hand, they find that every room they enter is carefully lighted, that the illumination is always sufficient, that the lamps

are properly shaded and kept clean, &c., they, in turn, will try to secure the same conditions in their own homes. There is an intimate connection between cleanliness and good illumination. A badly lighted, gloomy room naturally is not kept so clean as it should be, since the dust cannot be seen. Living in poorly-lighted rooms also encourages neglect of personal cleanliness.

The question may be asked: "What is meant by good lighting in a school-room?" Authorities in the chief countries of Europe and in the United States have recently been busy on this matter. It was referred to at the International Medical Congress in London last August, and was also the subject of special discussion at the Fourth International Congress on School Hygiene just concluded in Buffalo. In addition, a Special Committee, composed of members of the Illuminating Engineering Society, the Association of Medical Officers in Schools, the Association of Teachers in Technical Institutions, and other kindred bodies, have recently issued a preliminary report on the subject.

A few of the most important points may therefore be mentioned. In the first place, the illumination on the desks where the children read should be sufficient. The Committee recommend that the illumination on no desk should be less than 2 foot-candles. Some members of the Committee preferred 2½ foot-candles. A considerable number of tests have been made in schools in London, and it has been ascertained that an illumination of this strength is quite practicable. The figure has also a theoretical basis, for the researches of many physiologists seem to show that the eye becomes as it were "saturated" at this point; so that for reading purposes any great increase in illumination past this point produces relatively little increase in sensitiveness. This, of course, refers to larger type on good white paper. On the other hand, when sewing with dark materials is undertaken, a very much greater illumination would be needed, for the simple reason that such cloth reflects back to the eye but a small proportion of the light it receives; and though the illumination may be high, the actual brightness of the material will be small. Sewing always requires a good light; and it has been recommended that all fine work of this kind should only be done during the daytime.

Another point that received attention from the Committee was the avoidance of "glare." The dazzling effect of modern electric filaments and mantles is apt to be very trying and fatiguing to the eyes, when such lights fall in the direct line of view. It is therefore essential to ensure that the lamps are properly shaded, and that they are kept, as far as possible, out of the view of scholars looking towards the blackboard. In a small class-room, the general lighting may suffice to light the blackboard; but in many cases, especially where diagrams in coloured chalk are used, special local lighting of the blackboard will be needed.

Among other points considered by the Committee are the avoidance of inconvenient head-shadows and troublesome reflections from shiny paper, &c. For school books, a dead white paper is preferable to a glazed variety. Both of these defects can be mitigated to some extent by arranging for the ceiling in the room to be white and the walls light in tint, so as to reflect the light to and fro, and produce good diffusion of light. The possibilities of the indirect and semi-indirect methods of lighting for class-rooms also merit consideration; but opinion is divided as to their utility.

The Committee of the Illuminating Engineering Society are now considering the natural lighting of schools. Quite recently an important scheme of inspecting the physical conditions of school children has been introduced; and it seems fitting to suggest that the scheme of inspection should include a study of the lighting conditions. The provision of glasses for weak-sighted scholars is certainly a step in the right direction; but it is surely still more important to remove the causes of defective vision, among which may be reckoned poor illumination. The gravity of the matter may be realized when it is stated that there are in the schools of London alone over a million children. The preservation of the eyesight of the coming generation is a matter of national importance; and the good work that is being done in this direction by this conference and by the co-operation of the Illuminating Engineering Society deserves emphatic recognition.

Mr. A. J. Martin (who proposed a vote of thanks to the authors of the papers) emphasized the point that illumination was not high candle power, but the proper distribution of candle power; and it was upon the question of the distribution of light that too little attention had been bestowed hitherto. Too many people, even nowadays, seemed to think that lighting a room merely meant putting in a certain number of lamps of a certain candle power, without very much regard to where they were placed. An instance of the general views on illumination had been afforded when he recently moved into new offices. He gave his clerks a free hand as to the placing of the lamps, and every one placed them almost in front of his eyes. He preferred to have his at the back, out of the way of his eyes, even if in so doing he actually suffered from deficiency of light compared with the direct impingement of the rays from the lamp upon his eyes. Professor Thompson had done a great service in calling attention to the danger of glazed papers; and, as a matter of fact, almost any paper could be a danger, if the light was improperly placed. The great problem of illumination was to distribute the light in such a way that glare would be avoided; and it was an exceedingly difficult thing with a school-room containing forty or fifty children, to ensure that the lights were so placed that no children were exposed to direct or indirect glare. He hoped that the Board of Education, who he ventured to say were not infallible, would pay more attention to this matter, but not in the way of enforcing fads, because it seemed to him that the Board were inclined from time to time to pick up a hobby and ride it a little bit too hard to be pleasant. The Board, however, should secure inspectors who were specially qualified to deal with this question of illumination, and should also see that all the plans of schools submitted conformed to their requirements in this respect.

Mr. F. W. Goodenough, in seconding, confirmed Professor Thompson in the statement that the human eye is a bad photometer. His experience in regard to the measurement of the candle power of street lamps was that the human eye was quite unable to detect very considerable differences between the candle power of two lamps near one another, and it had also been proved that it was very difficult indeed to tell whether a lamp was of 1000-candle or 3000-candle power unless there were some means of contrast. The eye accommodated itself very rapidly to the measure of illumination around it. On entering a building or a street lighted with strong lamps, the eye was at once conscious of a very powerful illumination; but if one remained in that illumination for any length of time, all appreciation of the magnitude of the lighting was lost. On the question of the shiny paper, he thought they might have a little joke at the expense of the Illuminating Engineering Society, because the proofs of Mr. Gaster's paper which the Society had sent to the meeting were printed on a rather shiny paper, while those which the exhibition authorities had provided were on a paper which had no reflecting power They could very well say to the Illuminating Engineering Society: "Physician, heal thyself." One of the difficulties in this connection was the printing of half-tone blocks on paper that was not "art" paper. There was now, however, a process, known as the "off-set" process, whereby, as would be seen in one of the pamphlets Mr. Dow had, such blocks could be reproduced on an absolutely non-shiny paper quite as satisfactorily as they were previously printed on "art" paper. Sir George Kekewich had mentioned that he was a lover of the open fire. Doubtless, they all were; and therefore there was some reason to rejoice in the fact that the gas-fire of the present day more nearly resembled an open fire than any other appliance yet produced, for radiant heat was now being obtained from the gas-fire resembling the radiant heat from a coal-fire. It was true that one could not poke the gas-fire; but they were getting almost to this point. Dr. Leonard Hill said some time ago that there was nothing he could say in favour of the open coal-fire that he could not say in favour of the open gas-fire. With the exception of the fact that the gas-fire was regular burning, and the coal-fire was irregular burning, there was practically no difference between the two, except that one was burning purified gas and the other unpurified gas. Experience or tuition made one realize that it was impossible to educate a child properly in an ill-lighted, ill-ventilated, or ill-warmed school; and he was glad to think that this fact was gradually penetrating the intelligence of those responsible for the designing and equipment of schools. It was to be hoped that the papers at the conference would have their effect in still further making this point realized by the education authorities.

Mr. J. G. Clark said there were very many examples of bad lighting in schools; and it ought to be recognized that this did not tend to economy in the consumption of gas or electricity, as the case might be. Indeed, a proper distribution of the light would not only give better illumination, but would in most cases effect an economy in consumption. Personally, he thought there was no reason why nowadays they should not have something approaching an ideal system of lighting. By this he meant that there were appliances available which, if properly used, would bring this about. There had been very great improvements in the methods of producing light; but the application and distribution of light had not kept pace with the improvements in its production. The necessity for having the lights in the right place could not be too strongly insisted upon; and even in these days it seemed difficult to make some people realize that different circumstances required different treatment, and that conditions of lighting which were satisfactory in one case were totally unsuited for another. He had had a very striking example of this only recently, where a man could not understand that a principle which was sound in one case was not sound in quite a different case. He concluded with a testimony to the good work carried out by the Illuminating Engineering Society.

Mr. P. J. Waldram called attention to the fact that neither of the authors had dealt with daylight illumination in schools, which, he said, was one of the most important aspects of school lighting, inasmuch as natural light was largely depended on for the greater part of the year.

The Chairman then put the vote of thanks, which was carried with acclamation.

Professor Thompson thanked the meeting on behalf of Mr. Gaster and himself. He said he had been asked why he did not deal with daylight illumination. In the first place, it would have made the paper too long; and, in the second place, it would hardly have been appropriate in a gas exhibition, where the essence of the whole thing was to use gas as an artificial illuminant. Thirdly, he knew very little about it; and, fourthly, the Committee of the Illuminating Engineering Society who were dealing with this aspect had only made an interim report, and were still continuing their labours. The subject was also being investigated in other countries; so that there was every hope of some valuable infor-

mation of the sort referred to by Mr. Waldram—who, by the way, was quite the leading authority on the question, certainly in this country—being available in the near future. He concluded by mentioning an instance of how the lighting of large buildings was sometimes carried out, even in these days. An architect designed the building in question, and in the first place the lighting was entirely overlooked. It was later on sublet by the main contractors to a firm who simply, from an inspection of the plans, and without knowing the purpose for which a single room was to be used, decided to specify so many lamps for each room. In school lighting, the subject was a very special one; and there ought to be classes where architects could be trained for this particular purpose. They ought to have in London some great establishment of the sort. He was told that there was a school of architecture in London; but he understood there were no lessons given there on the particular question of lighting. He might be misinformed, and would be very glad to hear that the contrary was the case.

Mr. J. S. Dow also acknowledged the vote.

COOKERY IN THE SCHOOL.

Miss Mildred Atkinson, B.Sc., dealt with "Cookery in the School," and emphasized the advantages of gas cookery.

Mrs. Price proposed a vote of thanks to her, and

The Chairman, in putting it to the meeting, said that one result of listening to Miss Atkinson was that he felt he must now have a gas-cooker installed in his house, as he had been rather convinced that the chief occupation of his cook was to see how much coal she could burn. The proper illumination of the poor man's home, he thought, rested rather with the landlords, who would have to be converted to a knowledge of how houses should be lighted.

Miss Atkinson, replying on the latter subject, said that the working classes really had more power in the matter than they realized; for if they over and over again pointed out to the landlord that they would not put up with certain things, some of the very wrong methods of illumination in use would be changed.

LIGHTING, HEATING, AND VENTILATION OF THE SCHOOL OF THE FUTURE.

Messrs. Septimus Warwick and Austen Hall read the final paper, on "The School of the Future."

The contribution was a lengthy one, and it is only possible here to give some extracts from it. The authors said it is a very expensive matter to remedy blunders concerning illumination, heating, and ventilation after a school has been built and fitted up. In these matters, there is obvious necessity for close co-operation between the architects who have to plan the buildings, the medical officers who are responsible for the health of those who will occupy them, and the committees and teachers who are responsible for the success of the work carried on therein, using the word "success" in its broadest and truest meaning. The old idea that the architect's business was to plan buildings without reference to those who had afterwards to live in them, should be, if it is not, quite exploded. There is another body with which the architect is now able to consult in these and similar matters, and that is the Illuminating Engineering Society, which promises to be a most useful consultative body, and is doing valuable work in calling attention to the greater need for the application of scientific principles to the illumination of our homes, schools, factories, and other premises.

The impossibility of dealing with our subject in all its aspects being obvious, we propose now only to treat of one or two broad principles of illumination, heating, and ventilation; and then to point out briefly in what way gas can assist in the practical and economical application of these principles, where a supply of gas is available and the authorities decide upon its use. The acutely controversial questions as between gas and its rivals we propose to leave to the protagonists in the various camps to fight out for the benefit of the consuming public. We will not quote the old proverb as to the disagreement between thieves, but in milder language point out the advantage to the public of competition between those who have in their hands the supply of public necessities. Our dealing with gas in this paper must not be interpreted as necessarily committing us to an advocacy of its use in every circumstance and case. We believe that there is a place for all the various rival illuminants in the service of the community; and we are only concerned here with considering how gas can best be utilized as light and fuel where it is adopted for these purposes. At the same time, as members of a profession keenly interested in the preservation of buildings from defilement and destruction, we should like to express our appreciation of the value to the community of the steady purification of the atmosphere that is accruing through the increased use of gas for fuel, and to welcome the great improvement in the design of gas-fires in recent years, which makes it possible for a self-respecting architect to recommend the installation of these fires in the most æsthetic surroundings.

It is of great importance that sources of light should not be fixed so as to come within the line of normal vision of scholars when they are looking either at the teacher or at the blackboard, and that all sources of light should be so designed as to have as large a diffusing area as possible. This can easily be obtained by the use of opal, frosted, or cut-glass globes. But this, of course, tends to reduce the amount of light obtained for a given consumption of lighting energy; and the principle is found to be most generally disregarded where the more expensive illuminants are in use. This is a point to which we think it is impossible for too much attention to be given, if the eyesight of children is to be protected during the period of their education.

We append to this paper a copy of the preliminary report of the Joint Committee appointed by the Illuminating Engineering Society of England to consider the "Artificial Lighting of Schools,"* as this will no doubt be found of value by all interested in the subject. We may, therefore, with reference to one or two points in particular, leave the consideration of the scientific illumination of school buildings. The particular matters which we wish to emphasize are the necessity for realizing the effect upon both daylight and artificial illumination of the colouring schemes adopted in the decoration of schools. One sometimes finds class-rooms painted with high and very dark dados, having an almost total absence of reflecting power; and those interested in this subject may be referred to the section in the exhibition where will be found a number of cubicles lined with different coloured papers, but each illuminated with a similar unit of light—demonstrating the different absorptive powers of various colours upon light. The other principal point which we wish to emphasize is the necessity for arranging the sources of light, whether natural or artificial, so that scholars do not have to sit at unnatural angles in order to avoid working in their own shadows. We may also add a word as to the importance of seeing that the light in any room is as evenly distributed as possible, so that sufficient light is given to the students of weakest sight and to the students placed in the farthest corners without giving excessive light to any student.

Much importance is attached by some people to the method of lighting known as "indirect," whereby the source of light is entirely obscured from vision, and the illumination of the room is obtained solely by reflection from wall and ceiling. This is an expensive method of artificial illumination, the necessity for which has not, in our opinion, been adequately established. Semi-indirect methods of lighting, such as can be seen in some of the corridors of the model rooms in the exhibition, are, in our opinion, equally, if not more, satisfactory from the point of view of illumination, while less expensive, and also more constantly efficient, because less dependent upon the cleanliness of walls and ceilings.

There is one point that needs to have attention drawn very emphatically to it—that whatever the system of lighting that is adopted, and whatever the illuminant employed, "maintenance" of the lighting in a state of efficiency is most essential. It is no use installing efficient gas-burners if they are not kept periodically clean, and if the mantles are not renewed until someone complains that the light is bad. It is no use installing the most up-to-date electric filament lamps if these lamps are allowed to remain in use after their efficiency has become impaired. It is, in short, very false economy to cut down the expense of maintenance below the cost of effective upkeep, as you are then paying for gas or current, as the case may be, from which you are obtaining no light. It is in the end far better economy to employ experts to give this matter periodical attention, than to allow it to be within the province of the casual caretaker or the handy man, the one of whom perhaps takes care most particularly not to do more work than he or she is compelled to do, while the other is more particularly "handy" upon any job than the one specially to be done.

We now want to point out the close relationship that can exist between the lighting and ventilation when gas is employed. At one time, it was quite common to find in every public hall gas "sun" burners in the roof; but upon the introduction of the more economical incandescent gas-burner and the adoption in many cases of electricity as an illuminant, this method of combining lighting with ventilation temporarily fell into disuse, to the great disadvantage of the users of many of the buildings in which they were formerly employed, as such burners constituted a powerful engine of useful ventilation. Now that it has been found practicable to employ incandescent mantles in these "sun" burners—as can be seen in this hall, in the restaurant, and in the banqueting hall—and now that the difficulties of maintenance have been overcome by means of satisfactory lowering arrangements, this system of at once lighting and ventilatiug large buildings is again becoming popular, and deservedly so.

But this method of combining lighting and ventilation need not be confined to large college halls and buildings of similar magnitude. It can be equally well employed in much smaller rooms, as can be seen by an inspection of the lighting arrangements displayed for the illumination of offices in the adjoining hall in the exhibition. These smaller incandescent ventilating lamps have taken the place of the old luminous flame regenerative lamps which were very popular some years ago; and they can be strongly recommended for the lighting of class-room and similar apartments. The products of combustion pass from the ceiling into a flue, which is carried either into the chimney of the room or into the open air, with proper arrangements for preventing "back-draughts." If reasonable provision is made for the intake of fresh air into a room, the use of these lamps solves the problem of ventilation very satisfactorily in dark and cold weather; and all the ingenuity of man has not yet devised any much more satisfactory system of ventilation in hot weather than an open window.

Even, however, if no special type of ventilating gas-lamp is

* This report was reproduced in the "Journal" for July 15 last, p. 173.—Ed. J.G.L.

used, it may be said that there is something radically wrong with the construction of a room of normal dimensions if the use of sufficient gas by modern burners to light the room adequately materially increases the temperature in that room, or causes any noticeable rise in the CO_2 contents of the atmosphere. This, which is the experience of many users of gas lighting in rooms which have normal means of ventilation, has also been established by the independent tests of such men as Dr. Rideal, the eminent research chemist, and Dr. Toogood, the Medical Superintendent of Lewisham Infirmary.

It is to be hoped that architects and school managers will, when employing gas for lighting, bear in mind the modern improvements in gas burners and lamps which enable it to be utilized as an active instrument of ventilation, not merely removing its own products of combustion, but helping materially to remove the products of respiration of the occupants of the room, and so maintaining the vitality of those occupants at a higher level than would be maintained in an ill-ventilated building.

Passing now to the consideration of the way in which gas can be put to the service of the educationist for heating purposes, one would first of all like to emphasize what has already been pointed out elsewhere by competent authorities (notably by Professor Leonard Hill)—that, for the purpose of securing the best hygienic conditions in any room, radiant heat is of far greater value than convected heat.

For large school-rooms and similar buildings, a system of open fires as the sole means of heating would be a costly matter, owing to the labour entailed in the use of coal on the one hand, or the cost of the gas for constant heating on the other. But here we are able to arrive at a reasonable compromise for the heating of large rooms in very cold weather. A central boiler, heating radiators to a moderate temperature throughout the building, will warm the air of the rooms, without heating them to an uncomfortable degree, provided that the area of radiation allowed is not excessive, and that the radiators are not permitted to become overheated. To enable such an installation to keep a building comfortable during the most severe weather, and take the place of such an installation during those periods of the year when warmth is only wanted spasmodically (perhaps in the early morning or the late afternoon), the installation of gas-fires in every room is suggested as a satisfactory complement. These fires can be lighted at a moment's notice, and put out with equal expedition; so that the consumption of fuel is confined precisely to the period during which heat is required, while their effect in assisting the ventilation of a room and in providing radiant heat will make for the comfort of the inmates. For use in the living-rooms of teachers and students in colleges and universities, gas-fires present obvious advantages, as they entail no labour, make no dirt, and are available for use just as and when wanted. The advantage of a boiling-burner attached to the fire also makes it possible for a teacher or a student to make hot food or drink at any hour of the day or night, when it might be very inconvenient or even impossible to obtain it in any other way.

Architects, in the planning of college quarters, must in future make provision for the laying-on of a gas supply to every room, so that this cleanly method of heating can be installed at any time that the college authorities may desire it, without the disturbance to the buildings that is sometimes entailed in the installation of modern methods of heating in old buildings.

The paper concluded with references to the advantages of gas in schools for cooking, laundrywork, laboratory equipment, hot-water supply, and water-sterilization.

Mr. Edward Allen, who proposed a hearty vote of thanks to the authors, said the gas industry was pleased to find architects were taking up this important question. Gas men thought they had the particular thing required for light, heat, and ventilation in schools—and everywhere else—and they desired that architects and similar leaders of industry should understand what could be done, so that they could wisely instruct their clients.

The Chairman, in putting the vote, said he had heard it whispered that the London County Council were somewhat deficient in their duties as regarded the maintenance of school lighting installations, inasmuch as proper instructions were not given to the caretakers in this respect. No doubt, if what had been said at the conference could be conveyed to the Council, the matter would be put right.

Mr. Goodenough proposed a vote of thanks to Sir George Kekewich for the able and genial way he had presided.

Mrs. Cloudesley Brereton seconded. She said she was responsible for inviting Sir George to preside over the conference, and had listened with interest to his reminiscences of the Board of Education. She herself had been an official under the Board during the time Sir George Kekewich was its Secretary. The educational world owed a great deal to a man like Sir George, who, after he had retired, spent all his time in giving unfettered advice to the outer world.

The vote of thanks was carried, and the conference closed.

POPULAR LECTURES.

EVOLUTION OF GAS LIGHTING AND HEATING.

By Professor Vivian B. Lewes.

Professor Vivian Lewes delivered his third and final lecture on this subject last Tuesday; the lecture hall being crowded. Alderman W. Kay, of Manchester, presided.

The Professor dealt first with the structure of the incandescent mantle, and illustrated this part of his lecture by means of a number of micro-photographs, which demonstrated the characteristics of the cotton, ramie, and collodion mantles before and after burning-off, incidentally referring to a ramie mantle which had burned for 3400 hours. The disadvantages of the cotton and ramie mantles were dealt with, and the reasons for the superiority of the collodion mantle were given.

From this, Professor Lewes passed to the hygienic side of the use of gas, into which he went in some detail. When the electric light was first introduced, the idea in everybody's mind was that it must be a far more healthy light, and one which damaged the air of the room much less than gas, and that it was from all points of view a more hygienic light. Electricians did not let this idea rest, and always brought out that, inasmuch as electric light took nothing from the air and added nothing to it, it must be a far superior light to coal gas, which not only took oxygen from the air, but added to the air carbon dioxide or water vapour. His own personal experience, however, did not quite bear this out. For three or four years he never doubted the dictum of his electrical friends, although he had always felt much more comfortable in a gas-lighted room than in an electrically-lighted one. He looked upon this, for a time, as some strange warp in his own character; but he continued to notice this effect, and several things made it more and more apparent. He frequently lectured at the Society of Arts; and in the days when the old "sunlight" gas-burners were used, they gave a nice, "dim, religious light;" but it was a very well ventilated room, because these lights drew in, through the air inlets, a large amount of air. Later on, the Society suddenly blossomed out into all the wonders of electric light. They had incandescent lamps all over the place. There was a great deal more light than when the old "sunlight" burners were there; but while he was lecturing he felt that he was getting hotter and more uncomfortable. He felt that the air was more oppressive than he had ever noticed before, and, what was more, two or three members of the audience also felt it and went out. This was the sort of thing which impressed itself at once upon a lecturer, because one's audience was usually fairly polite, and sat the lecture out. The reason for the audience leaving, the lecturer would never by any chance associate with himself.

The result of this was that he carried out a number of experiments in a room which he could light either by gas or by electricity; and there again he found that, when he took in a fellow sufferer to keep him company, they both experienced that the atmosphere of the room was getting more and more uncomfortable when lighted by electricity than when lighted by gas. He then set to work and made a number of experiments with the atmosphere, and found that his feelings were perfectly well reflected by the results which these experiments gave—that the air at the breathing space was distinctly purer with the gas lighting than it was with electric lighting. Then he tried the space above the burners, and found that there the results were in the opposite direction—*i.e.*, that the effects of the products of combustion in the case of gas caused the air above the breathing space to be more impure than when electric light was used; but the breathing atmosphere below the level of the burners in the case of gas was by far the most hygienic. The real cause of this was that the gas-burners were giving rise to a large amount of heat. This heat, instead of dissipating itself completely throughout the room and so heating the air, caused the light air to ascend, and this, striking upon the ceiling space, diffused through the plaster of the ceiling, and in this way escaped through media which one would never have suspected of having any very great ventilating effect.

Turning to the laws of diffusion, he began to see the cause of the whole phenomenon. He believed it was towards the close of the eighteenth century that John Priestley discovered the fact that gases could not be arranged in layers according to their specific gravity, as could liquids. Gases, it was found, gradually intermingled against the forces of gravity, and they could recognize in this, possibly, the wonderful laws which worked in our atmosphere and made life a possibility. If it were not for this, in all those cities with large works, the carbon dioxide which was belched forth from all the chimneys would gradually choke out all life. Owing, however, to this wonderful power, the diffusion took up the carbon dioxide and spread it throughout the whole atmosphere; and the effect was seen in vegetation, which, in its turn, put oxygen back into the air once more. Thus oxygen was again brought back to the toiler in the city, who needed it for his life and well-being.

Having shown by experiments the rate at which gases intermingle, and the manner in which this takes place against the force of gravity, and also the ventilating effect of a piece of plaster as representing a plaster ceiling, Professor Lewes said that the reason why gas was more hygienic than electric light was that, although the latter took nothing out of the air and put nothing into it, it nevertheless left the air in a stagnant, heavy condition, which Dr. Leonard Hill had shown was a most fatal condition for

sanitary results. Although gas took oxygen from the air and gave off products of combustion, these products were a considerable help, not merely as a heating effect, but as a sanitary effect, inasmuch as they aided the destruction of bacteria and germs which were found crowded in a stuffy room, and finally, filtering away through the ceiling space, accounted for the blackness of ceilings. The necessity for this proper ventilation, and the fact that electric light in an ordinary room, even with a fireplace and chimney, did not bring about the same effect as gas, was shown by the simple experiment of a candle in a closed vessel with an opening at the top. There being no supply of air coming into the vessel from the bottom, the candle gradually died out. This was the effect on human nature of living in rooms with electric light.

Passing on to the development of gas heating, Professor Lewes said that the original idea of burning an open bunsen burner in connection with asbestos and fire-brick was quite wrong; and if anyone was in doubt as to the right way of doing a thing, he should turn to Nature. It would be noticed that the way the sun heated the earth was by means of radiation. This meant that the rays filtered through the air and did not heat the air, but when they fell on any solid object the rays heated the solid object quite slowly. These objects, heated by radiation, in turn heated the air. Applying this to a room, we had some such phenomenon as follows: With one of the original gas-stoves burning, the atmosphere was gradually heated. The whole of the air in the room got hot; but the solids in the room did not. This accounted for the fact that a person sitting in a room so heated would frequently feel what was thought to be a draught, though he might be sitting in a corner of the room where no draught, in the ordinary sense of the term, could possibly be experienced. What was really happening, however, was that the human body, which was at a temperature of 98° Fahr., had been radiating its heat to cooler objects, with the result that a chill was felt; and a chill of this sort was every bit as bad as a draught. The natural method of heating—*i.e.*, the method in which the sun heated the earth—was quite different. If, on a bright summer morning, one took two thermometers and put one in the shade and one in the sun, there would be a difference of 40° or 50° between them. Where the sun's direct rays were falling on the thermometer, the temperature would probably be 110°; but the thermometer in the shade would probably show only 60° or 65°. The reason for this was that in the shade there was no heat, which showed that the air was not being heated. Consequently, with a fire that radiated out its heat the air in the room was not heated, and the occupants were given cool air to breathe, which was one of the most important factors. The radiated heat, however, from such a stove heated solid objects in the room, and prevented their abstracting heat from the bodies of the occupants, and obviated the chill to which he had already referred.

This was where the modern gas-stove differed from the old one. An enormous amount of prejudice had been raised against the old gas-stoves simply because manufacturers used atmospheric flames in order to heat masses of asbestos, which, however, gave out a low amount of radiant heat; and when they found the efficiency was very low they used hot air-chambers at the top, which were intended to heat the air by convection. The result was that with these gas-stoves one only obtained from 20 to 25 per cent. of radiant heat from the gas, while there was perhaps as much as 40 per cent. of convected heat. These stoves were heating absolutely in the wrong way. And what was the proof of it? When air was heated, it became hungry for moisture. When they came into the meeting room that evening, if the temperature of the room had been taken, it would probably have been found to be about 60°. At that moment—it might be due to the fact that he had been exerting himself unusually—it seemed to him that the temperature was nearly 80°. At 60° each cubic foot of air only held at the outside 5½ grains of moisture; but at 80° it would hold 11½ grains. Where was the air in this altered temperature to get its moisture from? It laid contribution upon everything in the room which contained moisture; and as the human body was said to contain something like 75 per cent. of water, it was clear that the human body would experience discomfort as the temperature of the air increased. Plants were even more delicate than the human being, and when placed in a room heated in the ordinary manner they quickly drooped, because the evaporation from the leaves was more rapid than the moisture which it could suck up. It was this fact which first brought about the prejudice against the gas-fire, and which led to the curious custom of putting a bowl of water in front or on top of the gas-stove, so that its evaporation should enable the air to take moisture from the bowl; but the air never paid any attention to that.

The modern gas-stove, however, had altered all this, because there were now arrangements by which more and more of the heat given off by the gas was converted into radiant heat. Three years ago, 33 per cent. was radiant heat, and perhaps 25 to 30 per cent. convected heat; and this was considered a good performance for a gas-stove. Now it would be found that many of the gas-stoves in the exhibition were giving as much as 50 per cent. of radiant heat, while the convected heat was down to from 20 to 12 per cent.; and there was one stove in the exhibition which claimed to convert (and he believed the claim was perfectly well founded) no less than 72 per cent. of the heat in the gas into radiant heat. This indeed, contended the Professor, was heating at its best, as it gave heating of the same character as was obtained from the sun; and when they considered that gas as a lighting agent gave the enormous advantages that it did, when they considered that gas was the great abolisher of the smoke curse in this country, when they considered what gas saved in the labour which was entailed with coal-fires, and when they considered the perfection to which the use of gas had been brought as a heating agent, they must admit that coal gas was the fuel of fuels.

THE CONTENTS OF A LUMP OF COAL.

By Henry O'Connor.

On Wednesday and Thursday, Mr. Henry O'Connor delivered a lecture on "The Contents of a Lump of Coal"—starting at the commencement of the subject—namely, the time when the coal was beginning to be formed, and explaining why coal differs in various parts of Great Britain. Proceeding, he said it might be interesting to notice what becomes of the heating power in the coal when it is used for gas making. Fourteen-twentieths remain in the coke ready for use again, when this material is ignited; about five-twentieths of the heating power is in the gas, which can be used for lighting, heating, or cooking; and about one-twentieth is contained in the tar, which at the present time can be employed in other ways than for heating purposes, and thus becomes more remunerative. The whole of the heat of the coke is not available for sale, as a proportion of the coke made is employed for heating the retorts. This uses about four-twentieths of the whole heat of the coal, so that only ten-twentieths, or one-half, is put upon the market as saleable coke.

As illustrating the wasteful use of coal in houses, the lecturer mentioned that it takes about 4¼ lbs. of coal to boil a gallon of water in a copper kettle starting from cold; while a joint of beef weighing about 12½ lbs. requires some 17 lbs. of coal to cook it in two hours. One of the ways of reducing smoke pointed out is the use of a proportion of gas-works coke, which contains very nearly as much heat as coal—say, 14,200 heat units, as against 14,550 units for best coals—and can be obtained at a much lower price. The coal miners' strike, he added, taught many the usefulness and economy of coke; but there are still a great number of the public who might learn this lesson.

The subject of ammonia was next dealt with; the process of manufacturing sulphate of ammonia, and its uses, being concisely sketched. Sulphate of ammonia, Mr. O'Connor remarked, would have been better named "nitrate of sulphur," or given some other title which would have indicated to the farmer that it contains the nitrogen which he knows is what he requires. When, he said, the farmer finds a substance to his hand called "nitrate of soda," he concludes that it is better than "sulphate of ammonia," which does not contain the blessed name of "nitrogen" or "nitrate;" whereas, as a matter of fact, the latter contains 20 per cent. of nitrogen, while the former contains only 15 per cent.—or four to three in favour of sulphate. Comparing sulphate of ammonia with nitrate of soda weight for weight, the sulphate of ammonia is worth 25 per cent. more than the nitrate of soda, on account of the larger proportion of nitrogen contained in it.

Cyanogen and tar were also dealt with—the use of the latter on road surfaces being explained. The lecture concluded with some account of the many derivatives of tar.

FROM THE COALFIELD TO THE BURNER.

By Henry O'Connor.

Mr. O'Connor on Friday evening followed up the lecture just referred to by another, equally interesting to the general public, entitled "From the Coalfield to the Burner." This included a description of the complete process of gas manufacture, and some useful remarks on meters. The principles on which wet and dry meters are constructed were explained—Mr. O'Connor feeling that the reason why these are so much maligned is that the public do not understand how they are made or how they indicate the quantity of gas passed through them. Here followed some practical remarks—from which the audience should derive benefit—on the use of gas for lighting, heating, cooking, and power purposes. The remarks of the lecturer on the last-named point are reproduced.

There is no doubt that electricity provides a convenient power supply, and where power is only required intermittently, there are no stand-by losses; but where continuous power is needed, the gas-engine provides an infinitely cheaper form. I know of a printing firm in Edinburgh who, when starting a new works, installed electric motors to drive the various machines they required for their work. Luckily for the firm, they were extremely busy, and required to keep their machines running practically constantly. They soon found that the cost of doing this was much more than they had anticipated; and they speedily removed the electric motors, and fitted up a gas-engine to provide the power they needed. This proved a very economical substitute.

Little need be said at the present time in favour of gas-engines. The world's power is being rapidly converted from steam to gas, whether the latter be provided from the town mains or from special plants laid down in manufacturer's own premises. The supply from the town mains, however, eliminates a great deal of trouble and anxiety which are not absent when suction plants are in use. As one of the earliest experimenters with the gas-engine, and also with suction-gas plants, I can speak with some authority as to the comparative values. A further proof is also provided in the fact that all the suction-gas plants are provided with a con-

nection from the town-gas main, either for starting or in case of a breakdown.

For powers up to 4 or 6 H.P., used only from two to five hours daily, as also for small industries, and nowadays for agricultural purposes, the new quick-running gas-engines are not dearer, as regards first cost, than electro motors, and, as regards their running, are cheaper to the extent, under normal conditions, of from 50 to 60 per cent. The ground area required by them is no greater than that needed by electro motors of equal power; and the new engines can be obtained, like electro motors, ready to be set up and to work immediately.

For powers (say) from 4 to 10 H.P., running from five to ten hours daily, and for small works and the like, the new model gas-engines are slightly dearer in first cost, and require more space, than electro motors; but as regards their running cost and the cost per hour, including both interest and depreciation, they are materially cheaper than electro motors, and in their running are not dearer than suction-gas engines of the same power. There are excellent little gas-engines to be obtained in ¼, ½, ¾, and 1 B.H.P., at an approximate cost of £10, £15, £17, and £19 respectively. For powers up to 15 H.P., coal gas is cheaper than that from suction plants. In Sheffield, between one-seventh and one-eighth of the gas made is employed in engines.

HARNESSING THE FORCES OF NATURE FOR THE SERVICE OF MAN.

By A. J. Martin, Past-President of the Institute of Sanitary Engineers.

In the course of his lecture delivered on Saturday evening, Mr. Martin roamed over the whole field of industrial development from the imaginary doings of prehistoric man, who, it was conjectured, first marvelled at the wonders of Nature and did no more than worship them. He reviewed, in clever biographical style, the various early attempts to make use of Nature's forces, and finally settled down to a close consideration of our dependence upon coal; relating the various ingenious methods which have been suggested from time to time for avoiding what is sometimes referred to as the reckless manner in which we squander our coal, all of which he put on one side as impractical, inasmuch as their consummation cannot be regarded as likely within a period which can by any stretch of imagination be termed the near future. Consequently, as might be imagined, he came to the really practical proposition of economically burning coal—viz., in the form of gas.

Putting aside for a moment the delightful spirit of levity which had run through the whole of his lecture, Mr. Martin suggested that the architecture of dwelling-houses should be modified in order that the common use of the coal-stove should be abolished, and that, as an aid to this end, the Building Committees of Borough Councils, who have to sanction plans, should, if not consisting entirely of women, contain a proportion as members. Anticipating that this would be difficult to bring about, he made a very useful suggestion to the British Commercial Gas Association which, put into few words, was that this body should either build a house or block of flats, or adapt already existing premises to demonstrate exactly the way in which gas could be applied to dwelling-houses, incidentally abolishing the coal cellar. As an object-lesson to architects, he anticipated good results. In the case of flats he suggested the addition of a hot-water service supplied from a coke-fired boiler in the basement, and the daily collection, in air-tight receptacles, of garbage from the kitchens, to be consumed in the latter. Having done this, let them boldly approach the local authority for a reduction in rates.

Having discussed the use of gas for lighting and heating in comparison with electricity, Mr. Martin summed-up the advantages of gas as ventilation and of electricity as stagnation; at the same time he thought the difference was so small, that it would be straining at a gnat to object to either on hygienic grounds. He, personally, used both, and would be very sorry to be without either. As regards the amount of heat recovered from coal, however, electricity made but a poor show. A pound of coal yielded from 14,000 to 15,000 B.Th.U. Burned under the boilers of an electricity station, as little as 500 units, or between 3 and 4 per cent., of the total heat of the coal might reach the consumer. A pound of gas coal yielded about 5 cubic feet of gas, having a calorific value of (say) 540 B.Th.U. per foot, or 2700 for the 5 feet. In addition there was obtained about half a pound of coke, the heat value of which would be about 7700 B.Th.U. Taking this into account, there were realized, from a pound of coal, no less than 10,400 heat units, or more than twenty times as much as it would give in an electricity works. There were also the bye-products in the case of gas manufacture, which put an extra value on coal converted into gas, compared with burning under steam boilers, and the value of which had been put at no less than £1 13s. 7d. per ton of coal carbonized.

In an age when the cost of everything was on the upward grade, it was satisfactory to know that the price of at any rate one commodity—viz., gas—was on the down grade. But, low as is the price of gas, most of our gas undertakings could supply it still more cheaply were it not for an obstacle which was not very creditable to our national common sense. In days gone by, when the gas companies obtained their charters, flat-flame burners were used, and it was a matter of importance that the gas should be rich in illuminating constituents. Parliament accordingly prescribed that the gas should be of such a quality that a specified burner, consuming 5 cubic feet per hour, should give a light equal to that of, say, 16 candles. In these days of the incandescent mantle there was not the slightest need for such a standard; but it was still enforced in the majority of towns, with the result that the gas consumers of this country are taxed to the tune of some millions of pounds every year, for no earthly purpose except to enable a few of them to go on using their grandmother's gas-burners.

EASTERN COUNTIES GAS MANAGERS AT THE EXHIBITION.

The Eastern Counties Gas Managers' Association visited the exhibition last Friday, and held their ordinary half-yearly meeting there. There must have been close upon 100 members and associate members present. The *rendezvous* was the Reception Room, where, on the invitation of the Governor (Sir Corbet Woodall) and Directors of the Gaslight and Coke Company, the members were entertained at lunch. This special mark of courtesy and friendship was due to the fact that the Chief Engineer of the Company (Mr. Thomas Goulden) is the new President. Many of the members arrived early, and made a particular and systematic examination of the exhibition during the morning. But at the time appointed they assembled for lunch.

Mr. Goulden was in the chair; and among those with him at the top table were the retiring President (Mr. T. A. Guyatt, of Ely), the Vice-President (Mr. W. B. Farquhar, of Ilford), and the Hon. Secretary (Mr. Joseph Davis). The honoured guests included the President of the Institution of Gas Engineers (Mr. Edward Allen), the Hon. Secretary (Mr. W. E. Price), and the Secretary (Mr. Walter T. Dunn). Various members of the Committee of the Association were also there. In the vice-chairs were Mr. Henry Rayner (the Secretary of the Gaslight and Coke Company), Mr. T. S. Lacey, Mr. F. W. Goodenough, and, in the absence at the time of Mr. J. N. Reeson, Mr. J. H. Troughton occupied his place.

The President of the Institution.

At the conclusion of luncheon, the toast of His Majesty the King was honoured; and immediately afterwards,

The Chairman said it was a great pleasure to the members and himself that the President of the Institution had been able to give them the honour of his company that day. To their great regret, however, Mr. Allen had to leave shortly; and therefore, without further prologue, he (Mr. Goulden) would ask the members to drink to the health of the President of the Institution.

Mr. Allen, in reply, said he was very grateful to Mr. Goulden for having given him the opportunity of representing the Institution, and of saying how interested the Institution and the President were in the Eastern Counties Association. The Institution would not exist but for the manner in which the work of gas engineers and managers was attended to by the various Associations, who met as members of the Institution only once a year, while the members of the Associations were always meeting each other in the course of business in their respective districts and at the half-yearly or more frequent meetings of their local organizations. He thought the idea of having this meeting in the exhibition buildings was a splendid one, because they were able to see an exhibition that had excited universal admiration. There was no question that here they had the last word in gas exhibitions; and he (Mr. Allen) must be permitted to say that they could not but admire the work done by Mr. Goodenough and those who had been associated with him in carrying out this important demonstration of gas in the interests of the general public. He also wished to say how pleased they all were to meet the gentlemen called traders, without whom the business of the gas industry could not be carried on, and to express the hope that the union which existed between them and the British Commercial Gas Association and the manufacturers who were not members of that important body, as well as their respect one for the other, would grow stronger year by year. He was sure that they would all be happier, and the industry would be carried on all the better.

A Hearty Welcome from the Hosts.

The Chairman remarked that he had next to apologize that he, rather than the Governor of the Gaslight and Coke Company, occupied the chair. Sir Corbet would have come had he been able to do so. He had anticipated this meeting with very great

pleasure; but, as the members knew, he was a man who was at the call of many duties, and there was no duty to which he was called to which he did not respond, if it were at all possible. It was a matter of great regret to the Governor that he could not be there. He (Mr. Goulden) therefore trusted that those present would accept him as a poor substitute in addressing a few words of welcome to the members as the guests of the great Company with which he was connected. The President of the Institution had told them what a magnificent exhibition they had in this building. No one could walk through the exhibition without seeing the evidence of the spread of the industry. The exhibition was a commemoration—a commemoration of the centenary of public gas supply, and a commemoration of the jubilee of the foundation of the Institution of Gas Engineers. These were two remarkable facts; and there was reason for great congratulation in that, at the end of a century of public work, the industry occupied such a magnificent position as it did.

A GOOD OUTLOOK—COAL SUPPLANTED IN THE METROPOLIS.

As a matter of fact, during the last ten years, there had been a vastly greater progress in the uses of gas than in the whole of the previous ninety years. It was not so long ago that the use of gas was very limited. He was speaking of the time immediately preceding the introduction of the incandescent light. There was then flat-flame lighting. It was poor. The use of gas for heating was then practically confined to a few cooking-stoves. There were a few heating-stoves; and they were also poor in design. But what did they see that day? They saw gas applied to almost every phase of domestic life; and it was remarkable to see how thoroughly it now entered into domestic economy. Its application to industrial uses was such that they could not believe there was any limitation to it. He was quite sure there must be very few industries in the country, if any, the work of which would not be much benefited by the use of gas. It was all really remarkable. Then, again, look at gas from the point of view of hygiene. He (Mr. Goulden) recently made a calculation regarding the gas consumed in the Metropolitan area for heating as apart from lighting. Taking the number of heat units the gas contained, by a simple computation he arrived at what he considered to be the amount of coal supplanted in the Metropolitan area by the use of gas for heating. The amount was something between 1½ and 1¾ million tons. Consider the effect of the soot, sulphurous acid, and the other products that would have been sent into the air if this additional amount of coal had been employed in its raw state. It was tremendous to think of it all, even apart from the waste to the community. At a recent scientific lecture, an account was given as to the results of researches into the effect of a soot-laden atmosphere on persons suffering from pulmonary diseases. The fact was established that the effects of pulmonary disease were immensely aggravated, and the ultimate effect was hastened, by the inhalation of smoke. Then there was the effect on public buildings; this was a serious source of expense and trouble. It was the part of gas men to mitigate these evils, and he maintained that the gas industry was playing the part nobly and well. But this work wanted starting, pushing, and maintaining. It could not be done by legislation. Therefore the industry must be its own supporter in the matter; and, by attention to the public, must do its best to improve upon current conditions. It was advisable, especially in the interests of public health, that domestic fires should be done away with. He should also like to bear his testimony to the work the British Commercial Gas Association were doing in the education of the public—work benefiting the industry and the public as well. But they as gas makers had to do their part in providing cheap gas, in order to help forward this movement, and so realize as early as possible the larger future which they were all sure was before the industry. He, as representative of the Governor and Directors of the Gaslight and Coke Company, drank to the health of the President and members of the Eastern Counties Gas Managers' Association.

The PRESIDENT (Mr. T. A. Guyatt) thanked Mr. Goulden for his remarks, and for the good wishes he had expressed towards the Association. He was sure that the members could not leave the table without expressing gratitude for the excellent way in which they had been entertained by the Governor and Directors of the Gaslight and Coke Company. They were all extremely sorry Sir Corbet Woodall could not be with them; but they fully recognized how many and important were his engagements.

Mr. R. G. SHADBOLT proposed the toast of the President-Elect (Mr. Goulden). He remarked that they had heard of the centenary of the industry of public gas supply, of the jubilee of the Institution, but no one had said anything about this being the 25th anniversary of the foundation of the Eastern Counties Association—an Association which had progressed so that its members were not content with anyone less for their President than the Chief Engineer of the Gaslight and Coke Company.

Mr. GOULDEN heartily thanked the members for the enthusiastic way in which they had drunk the toast.

THE BUSINESS MEETING.

Later in the afternoon, the business meeting was held in the banqueting-hall. At the beginning of the proceedings, the retiring President (Mr. T. A. Guyatt, of Ely) occupied the chair.

DEPARTED MEMBERS.

The PRESIDENT observed that since their last meeting the Association had sustained losses by the death of Mr. C. W. Grimwood, of Sudbury, Mr. T. Greaves, of Melton Mowbray, and Mr. J. Armitage Drake, of Halifax. The first two gentlemen were among the founders of the Association, and Mr. Grimwood was a Past-President. Mr. Drake was elected an associate member in 1899. He thought the members would agree that they should pass a vote of condolence with the families of their late friends; and he would ask them to do this by silently rising in their places.

MINUTES OF LAST MEETING.

The HON. SECRETARY (Mr. Joseph Davis, of Gravesend) read the minutes of the meeting held at Cambridge on April 24 last; and they were confirmed.

LABOUR EXCHANGE LIGHTING.

Mr. JOHN CARTER (Lincoln) asked whether there had been any result from the discussion at the last meeting upon the order that had issued from the Board of Trade regarding the lighting of Labour Exchanges. It was a subject that ought to be followed up, for the purpose of getting the order reversed.

The HON. SECRETARY replied that, after the last meeting, he wrote to Mr. Dunn, asking that the matter should be brought before the Council of the Institution, and urging that prompt measures should be taken with a view to getting the order abrogated, if any such order was in existence. He (Mr. Davis) afterwards learned that some steps had been taken. In a subsequent letter, Mr. Dunn also said the matter was being inquired into. But since then he (Mr. Davis) had not heard anything further regarding the subject. [Laughter.]

NEW MEMBERS AND ASSOCIATE MEMBERS.

The HON. SECRETARY having reported the receipt of letters of regret, read the names of the new applicants for inclusion on the membership roll.

As Members—

Mr. W. J. Rendell Baker, of Mansfield; Mr. T. S. Lacey, of London; Mr. E. W. Morley, of Haverhill; Mr. J. W. Rann, of Mablethorpe; Mr. G. Robinson, of Pinner; and Mr. J. Wilkinson, of Nottingham.

As Associate Members—

Mr. W. A. Drake, of Halifax; Mr. G. H. Perry, of Stourbridge; Mr. Herbert Saville, of Leeds; and Mr. B. Young, of Manningtree.

The nominations of these gentlemen were ratified.

THE OUTGOING AND THE INCOMING PRESIDENTS.

The PRESIDENT said the time had arrived for him to vacate the chair, and to ask his successor to take it. Mr. Goulden was so well known to all the members that no words of his were required to introduce him. They were greatly indebted to him for consenting to occupy the presidency of their Association.

Mr. GOULDEN, in stepping to the chair, was very enthusiastically received by the members.

The PRESIDENT said he had to thank Mr. Guyatt for the kind terms in which he had made reference to him, and to thank the members from the bottom of his heart for their reception. His first duty was a very pleasing one. It was to present Mr. Guyatt with the Past-President's Medal. It was indeed a beautiful medal; and he (the President) hoped that it would very often in the future serve to remind their friend of the pleasant year he had had in presiding over the fortunes of the Association. It was a year that had been made memorable by the manner in which Mr. Guyatt had upheld the prestige of the Association, and by the single-minded manner in which he had devoted himself to its interests, in doing which he had met with complete success. In presenting the medal he also wished to move a vote of thanks to Mr. Guyatt.

Mr. J. T. JOLLIFFE (Ipswich) seconded the motion, which was cordially carried.

Mr. GUYATT, in responding, said he did not think he had done anything to deserve so much kindness at the hands of his fellow-members. The medal would be a memento of a very pleasant year of office. It was only two years ago that they were kind enough to present him with a testimonial on his retirement from the office of Hon. Secretary; and now he had this additional souvenir. He should not lose interest in the Association, but should, like their other Past-Presidents, still attend the meetings as frequently as possible, and continue to assist in carrying out the laudable objects of the Association.

PRESIDENTIAL ADDRESS.

The PRESIDENT then delivered the Inaugural Address, which is reproduced on pp. 145-8.

At the close of the reading of the address,

Mr. JOHN CARTER proposed, and Mr. R. DENNINGTON (Cambridge) seconded, a hearty vote of thanks to the President for the instructive address he had delivered.

The proposition was carried with acclamation.

The PRESIDENT acknowledged the vote in a few apt words.

DISTRICT MEMBER OF COUNCIL OF THE INSTITUTION.

Moved by Mr. GUYATT, and seconded by Mr. W. J. CARPENTER (Great Yarmouth), the President was elected district member of the Council of the Institution of Gas Engineers.

PLACE OF NEXT MEETING.

Mr. JOSEPH HAWKSLEY (Lowestoft) moved that the next meeting should be held in Lowestoft. He reminded the members that it

was twenty years since they met in that town. He could assure them that if they agreed to meet there again now, it would be in pleasant surroundings, and there would be a hearty reception awaiting them.

Mr. W. J. CARPENTER asked to be allowed to second the motion, which was heartily carried.

The PRESIDENT assured Mr. Hawksley that the members would have the greatest pleasure in visiting Lowestoft.

HOSPITALITY OF THE GASLIGHT AND COKE COMPANY.

Mr. R. G. SHADBOLT (Grantham) said the members desired to place on record how deeply grateful they were to the Governor and Directors of the Gaslight and Coke Company for their kind hospitality that day. He moved accordingly.

Mr. J. CARTER seconded the motion; and the members endorsed it by applause.

The PRESIDENT, as Chief Engineer of the Company, thanked the members for their vote. Those associated with the Company were glad indeed to know that the hospitality that had been freely extended to the members had been enjoyed; and their best reward was the knowledge of appreciation. He should have great pleasure in conveying to the Governor and the Directors the vote of thanks that had just been accorded.

A VOTE OF THANKS TO THE OFFICERS.

Moved by Mr. W. J. CARPENTER, and seconded by Mr. G. R. CASTERTON (Melton Mowbray), a hearty vote of thanks was passed to the Past-President, the Hon. Secretary, the Committee, and the Auditors of the Association.

Mr. GUYATT, Mr. DAVIS, and Mr. FARQUHAR (on behalf of the Committee) having briefly responded, the formal proceedings terminated.

The members then continued their inspection of the exhibition; and in the early evening, they, or as many of them as the public would allow to pass into the Reception Room, enjoyed a vocal concert, for which Miss Margaret Balfour and other artistes had been engaged.

COOKERY HALL.

THE lectures were inaugurated by Miss Helen Edden, M.C.A., the Chief Lady Adviser for the Gaslight and Coke Company, who gave the first gas cookery lecture and demonstration in the afternoon of the opening day of the exhibition. She particularly emphasized the fact that the lectures had been arranged with the special object in view of demonstrating and teaching the economy of gas as a fuel, and were not to be looked upon as cookery lessons, but as gas cookery lectures. To further this end, the platform is raised a sufficient height to give everyone in the room an opportunity of seeing the whole process of roasting and baking in the gas-oven; the door opening towards the audience.

In the afternoon, the lecture was on the right method of baking cakes; and the management of the oven was clearly explained. In the evening, a plain dinner, consisting of twelve different dishes, was cooked in one hour; the consumption of gas being only 28 cubic feet.

Lectures are being given every day at 4 o'clock and 7.30 by lady experts in gas cookery; the crowded audiences testifying to their popularity, besides showing the anxiety of consumers to get as many "tips" as possible on the economical management of their gas-cookers. Miss Baldwin (Chief Demonstrator to the Croydon Gas Company), Miss Parkyn (Lecturer for the British Commercial Gas Association), and Miss Dobree Fox (Chief Demonstrator for the Hornsey Gas Company) have all succeeded in gaining the interest and attention of the large audiences present.

Mrs. Charles Marshall (Chief Demonstrator for the Enfield Gas Company) is organizing competitions for school children, housewives, scouts, &c., held daily at 2.30 and 6 o'clock, and these have aroused widespread interest. On Thursday evening, six bachelors competed, and caused much merriment. The competition for them was a quick breakfast, consisting of hot rolls, coffee, bacon, poached egg, and toast. They acquitted themselves well.

It is interesting to note that, at the expiration of twelve lectures, the meter registered 400 cubic feet of gas consumed; and the four meters for the ten competitions registered from 200 to 250 cubic feet—showing that economy in the use of fuel is being exercised, both by lecturers and competitors. Visitors to the exhibition are invited to inspect the meters and verify the facts stated.

DIARY OF EVENTS.

NATIONAL GAS CONGRESS AND EXHIBITION—October, 1913.

DAILY ATTRACTIONS.

STRING BAND OF THE SCOTS GUARDS, 3 to 4.30 and 6 to 7.30, IN THE DOMESTIC SECTION HALL.

MILITARY BAND, 8 to 9.45, IN THE DOMESTIC SECTION HALL.

MUSIC IN THE TEA ROOM, 4 to 5.

COOKERY LECTURE AND DEMONSTRATION AT 4 and 7.30 (EXCEPT 7.30 ON OCT. 31).

PRELIMINARY COOKERY COMPETITIONS OCT. 2 to OCT. 25 [INCLUSIVE] DAILY AT 2 30 and 6 (EXCEPT OCT. 8, 14, 22, and 23).

Tuesday, Oct. 14.

11 a.m.—**Judging of Home Cookery Competitions.**

2 p.m.—**Conference on the Hygiene of Lighting and Heating.**

Papers to be read :—

"The Hygiene of Gas for Lighting." By Dr. Samuel Rideal.

"The Health Value of Radiant Heat." By Professor Leonard Hill.

"Modern Improvements in Gas Lighting and Heating Appliances." By Professor Vivian B. Lewes.

8 p.m.—POPULAR LECTURE: "The Evolution of Gas Lighting and Heating" (Part I.). By Professor Vivian B. Lewes.

Wednesday, Oct. 15.

Visit of the Wales and Monmouthshire District Institution of Gas Engineers and Managers.

8 p.m.—POPULAR LECTURE: "The Evolution of Gas Lighting and Heating" (Part II.). By Professor Vivian B. Lewes.

Thursday, Oct. 16.

PATRONS' DAY.

3 to 5 p.m.—**Reception (by Invitation only) by the PRESIDENT and LADY WOODALL.**

8 p.m.—POPULAR LECTURE: "The Gentlewoman in her Kitchen." By Mlle. Claire de Pratz.

Friday, Oct. 17.

Visit of the Irish Association of Gas Managers.

11 a.m.—**Conference on Some Aspects of Scientific Illumination.**

Papers to be read :—

"The Aims and Objects of the Illuminating Engineering Society." By Leon Gaster, Esq.

"The Economy of Efficient Lighting." By Franklin Thorp, Esq.

"Light and Sight." By Meredith Young, Esq.

8 p.m.—POPULAR LECTURE: "The Evolution of Gas Lighting and Heating" (Part III.). By Professor Vivian B. Lewes.

Saturday, Oct. 18.

Combined Visit of Junior Associations. Mr. F. W. Goodenough Presiding at Tea.

8 p.m.—POPULAR LECTURE: "The French Hostess and her English Sister." By Mlle. Claire de Pratz.

Monday, Oct. 20.

8 p.m.—POPULAR LECTURE: "Construction, Operation, Testing, and Reading of a Gas-Meter." By W. H. Y. Webber, Esq.

Tuesday, Oct. 21.

Annual Meeting and Conference of the British Commercial Gas Association at the City Guildhall.

8 p.m.—POPULAR LECTURE: "Practical Hints on the Use of Gas in Factory and Workshop." By W. H. Y. Webber, Esq.

Wednesday, Oct. 22.

Annual Meeting and Conference of the British Commercial Gas Association at the Exhibition.

11 a.m.—**Judging of Home Cookery Competitions.**

Meeting of the Executive of the Sulphate of Ammonia Committee.

Private Dinner of the Sulphate of Ammonia Committee.

8 p.m.—POPULAR LECTURE: "The Origin and History of Artificial Lighting and Heating." By Edward Lovett, Esq.

Thursday, Oct. 23.

Imperial and International Day.

10.30 a.m.—**International Meeting of Sulphate of Ammonia Makers in the Conference Room of No. 5 Hall.**

11 a.m.—**Judging of Home Cookery Competitions.**

8 p.m.—POPULAR LECTURE: "Hints to Gas Consumers on How to Get Value for Money." By John Young, Esq.

Friday, Oct. 24.

2 p.m.—**Conference on the Economics of the Home (continued on Saturday, Oct. 25).**

Papers to be read:—

"Domestic Service as a Career for Educated Women." By Mrs. M. A. Cloudesley Brereton.

"Fuel and Light in the Working Man's Budget." By Mrs. Margaret M'Killop.

"Coal Gas as a Fuel for Domestic Purposes." By F. W. Goodenough, Esq.

"The Wife as Bursar." By Miss Mabel Atkinson.

8 p.m.—POPULAR LECTURE: "Hints to Gas Consumers on How to Get Value for Money." By John Young, Esq.

Saturday, Oct. 25.

11.30 a.m.—**Conference on the Economics of the Home (continued from Friday, Oct. 24).**

8 p.m.—POPULAR LECTURE: "A Pennyworth of Gas." By Dr. C. W. Saleeby.

Monday, Oct. 27.

11 a.m.—**Judging of Home Cookery Competitions.**

6 p.m.—**Final Cookery Competition for Housewives.**

8 p.m.—POPULAR LECTURE: "The Use and Abuse of Light." By Leon Gaster, Esq.

Tuesday, Oct. 28.

11 a.m.—**Conference of Employers.**

Papers to be read:—

"Co-Partnership as a Means of Increasing the Prosperity of both Capital and Labour." By Aneurin Williams, Esq.

"The Relation of Science and Industry." By Surgeon-General Sir Alfred Keogh.

"Co-Operation between the School and the Employer." By Cloudesley Brereton, Esq., L. ès L. Paris, and D. Milne Watson, Esq.

"Natural Law in the Commercial World." By A. F. Sheldon, Esq.

2.30 p.m.—**Final Cookery Competition for Territorials (A and B).**

6 p.m.—**Final Cookery Competition for School Children.**

8 p.m.—POPULAR LECTURE; "Practical Hints on the Use of Gas in Factory and Workshop." By W. H. Y. Webber, Esq.

Wednesday, Oct. 29.

11 a.m.—**Conference of Manufacturers.**

Papers to be read:—

"The Lighting, Heating, and Ventilation of Factories and Workshops." By Professor Vivian B. Lewes.

"Gas as a Fuel for Industrial Purposes." By Professor W. A. Bone.

"The Economic Value of Adequate Illumination." By Leon Gaster, Esq.

"The Matching of Colours by Artificial Light." By T. Thorne Baker, Esq.

2.30 p.m.—**Final Cookery Competitions for Boy Scouts, Girl Scouts, and Church Lads.**

6 p.m.—**Final Cookery Competitions for Sea Scouts and Territorial Nurses.**

8 p.m.—POPULAR LECTURE: "Practical Hints on the Use of Gas in Factory and Workshop." By W. H. Y. Webber, Esq.

Thursday, Oct. 30.

2.30 p.m.—**Final Cookery Competition for Cook-Generals.**

8 p.m.—POPULAR LECTURE: "The Silent Servant." By Miss Constance Williams.

Friday, Oct. 31.

6 p.m.—**Presentation of Prizes to Winners in Cookery Competitions by the Lady Mayoress of London.**

8 p.m.—POPULAR LECTURE: "A Pennyworth of Gas." By Dr. C. W. Saleeby.

Saturday, Nov. 1.

8 p.m.—POPULAR LECTURE: "Construction, Operation, Testing, and Reading of a Gas-Meter." By W. H. Y. Webber, Esq.

STRACHE'S GAS ANNUAL.*

DR. H. STRACHE'S gas annual for the year 1912 (recently issued) is the third of this series of gas annuals. In reviewing the two previous volumes [see "JOURNAL," Vol. CXVI., p. 525; and Vol. CXIX., p. 451], we expressed a hope that Professor Strache would for many years to come be able to continue to prepare so excellent a record of each year's progress in connection with the manufacture and use of gas. Our hopes, in regard to at least one more year, have been fulfilled by the issue of the volume which is now before us.

The volume resembles its predecessors in size and style, comprising about 130 quarto pages, with over 40 illustrations and diagrams. The review of the year's progress is given under about 40 headings. At the outset, matter relating to the history of gas lighting and the development in the consumption of gas is given. Then follows a summary of researches on combustion and flame production. Pyrometry, calorimetry, photometry, pressure measurement, and gas analysis are then dealt with, and (so far as we can judge) little of importance which has occurred during the year under review in connection with these subjects appears to have escaped the compiler's notice. He goes on to report on the analysis, storage, and transport of coals, carbonization, retort-settings, stoking and coke-quenching machinery, and the analysis of coke.

Then he deals in order with the treatment of the crude gas for the removal of impurities, gasholders and governors, tar and ammonia, and the distributing system. Following these sections come those dealing with the equipment of gas consumers' houses and the quality of gas. With the last named the portion of the volume dealing with coal gas proper closes; and the succeeding sections refer to water gas and various descriptions of fuel gas, special uses of gas, illumination, igniting appliances, gas-engines, &c.

Many of the matters reported on already have a sequel with which only those who follow the record in the Technical Press from week to week can be familiar. To such readers it may seem that the "Annual" is already some months out of date; but obviously it is impossible to compile and publish so exhaustive a record of progress made in a given year, until several months after the close of that year. To those who do not follow the weekly records in the Technical Press, an annual of this kind is invaluable; and others will find in it many points which may have escaped their notice at the time, or may have slipped their memory since. No gas man will find a few hours spent with Professor Strache's "Annual" wasted time. The volume is well indexed, and the authority is quoted for all statements made in the text.

* "Jahrbuch der Gastechnik." Im Auftrage des Vereines der Gas- und Wasserfachmänner in Oesterreich-Ungarn zusammengestellt, von Professor Dr. H. Strache, Leiter der Versuchsanstalt für Gasbeleuchtung, Brennstoffe und Feuerungsanlagen an der k. k. technischen Hochschule in Wien, Rat des k. k. Patentamtes. Mit 42 in den Text gedruckten Abbildungen und 1 Tafel. R. Oldenbourg, Munich and Berlin; 1913.

IDEAL GAS-FITTINGS AT THE IDEAL HOME.

The South Metropolitan Gas Company Demonstrate High-Class Applications of Economical Gas.

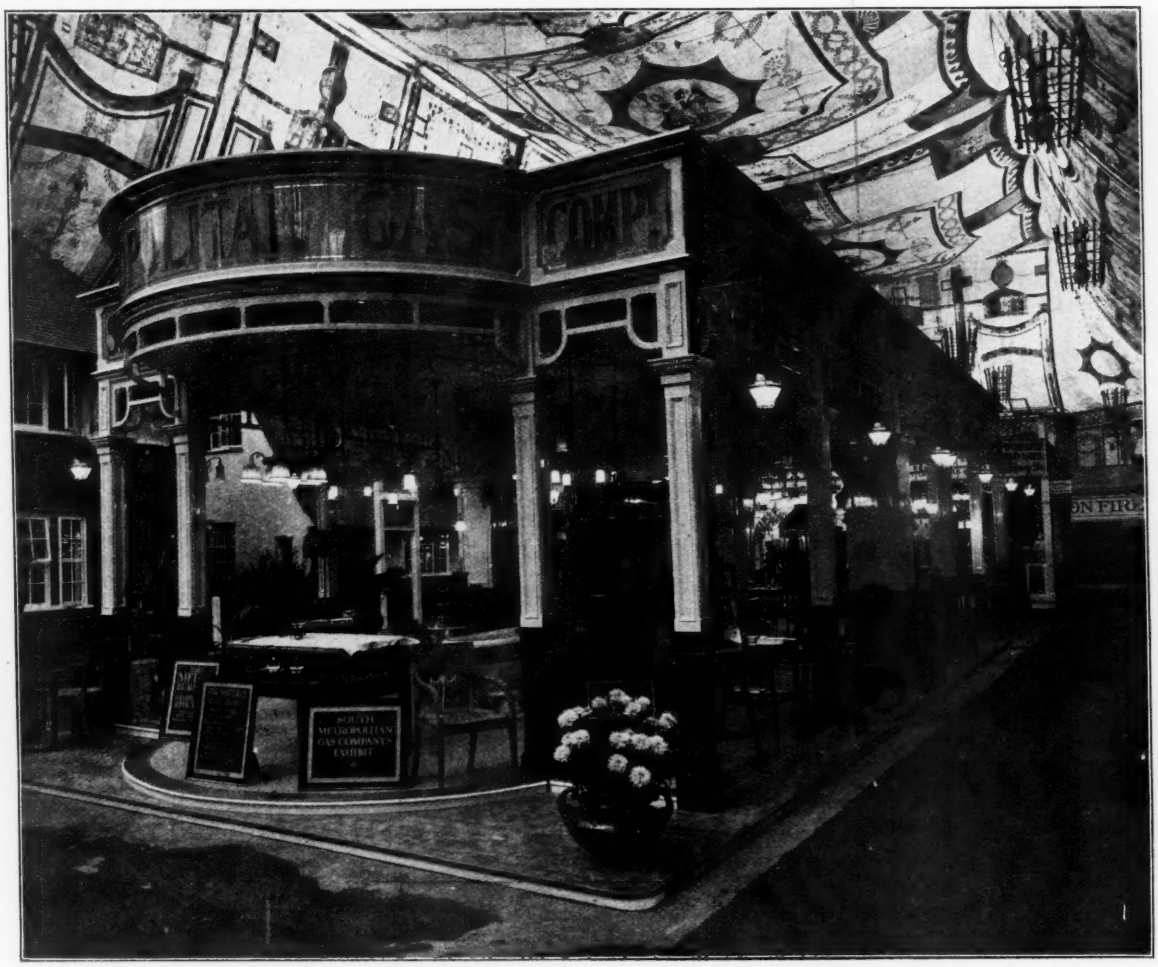


Photo. by Eorup, Streatham.

A FRONT VIEW OF THE MAIN STAND OF THE SOUTH METROPOLITAN GAS COMPANY AT THE IDEAL HOME EXHIBITION.

POPULAR as has been the Ideal Home Exhibition in past years, it promises to be even more so this year; for it is an excellent exhibition, and will have a magnetic influence upon the public. Of this there is great confidence. For last Saturday alone, the organizers of the exhibition were making special arrangements for attendants, anticipating that there would be at least 20,000 people visiting the place in the one day. They are justified by experience in this anticipation, seeing that, on the first Saturday of the run of the exhibition last year, there were some 17,000 visitors there. If what was accomplished last year in drawing the public is not exceeded this year, there will be genuine surprise; for the whole exhibition is one huge picturesque display, and every structure in it gives dainty expression to the best in their special line of work of the leading houses and firms who contribute to the making of the ideal home. The constituent features of the ideal home of the day all lean towards the artistic within the means of the householder, and towards the adoption of appliances that save labour and protect the home from dust and dirt. Here is the great and potent opportunity of the gas industry. People go to the Ideal Home Exhibition to see what is the latest that is on offer to render their homes more ideal than ever; and the people who visit the place are mostly those who, when they see what they want—something that will promote the home beautiful and home comfort—can afford to pay for it. Seeing that before gas lighting was what it is to-day in the matter of a refined decorativeness in application, and before the electric light had obtained an entry so largely into the homes of the wealthy, who study appearance and not quality or expense, it would be an absolute disaster, or at any rate an egregious and deplorable mistake, if gas were not represented at the exhibition, and its latest artistic phases demonstrated to those to whom the latter-day achievements are practically unknown. The fact that the National Gas Exhibition is in full and popular swing is not sufficient in the circumstances. There will be many people at this Ideal Home Exhibition who will not go to the Shepherd's Bush display; and these people it is very desirable to reach, if alone for the fact that —the Hammersmith Borough Council having a contract for the supply of electricity to Olympia the terms of which they jealously guard—the stands and model houses are practically all electrically lighted, except where gas is required to demonstrate the value of particular exhibits.

Therefore it is that the gas industry is indebted to the South Metropolitan Gas Company for having made a remarkably fine display at the Ideal Home Exhibition. They made a display there last year; they have worthily extended their enterprise this. In this veritable hot-bed of electric lighting, they have made a display of, primarily, gas lighting that is not exceeded in decorativeness by any electrically lighted stand in the exhibition. As a matter of fact, the Company are occupying nearly double the space that they did last year; and they are showing not only the highest class of artistic lighting and methods of heating, but they are demonstrating how gas contributes to the making of the home ideal for the middle-class householder and the artisan; and what is quite novel in exhibition work, they are showing a kitchen and a conservatory in which the provision of hot water for the house and the heating of the conservatory are entirely done by one coke-heated boiler. The whole conception of the display is excellent; the executed work must carry conviction.

THE MAIN STAND.

The structure of the main stand is the same as was used by the Company last year; its gas equipment is different. The stand for exhibition purposes could not be bettered, as no matter from which side the visitor may be making observation, he can see all over the two sections, and observe the beauty of the goods displayed, which, in the matter of the lighting fittings, look more beautiful still when the burners are in use. The stand is in a good position—better than last year, and no one can miss it. There is tastefulness in its decoration. The choice Rose-du-Barry coloured carpet, the elegant pedestal vases supporting luxuriantly blooming plants, the handsome chairs—everything is done to impress with the sense of refinement, in the setting to what are the principal exhibits. It is at the front of the stand where we are at the moment; and, as we look round, it is difficult indeed to imagine that anyone could inspect what is to be seen there, and say that

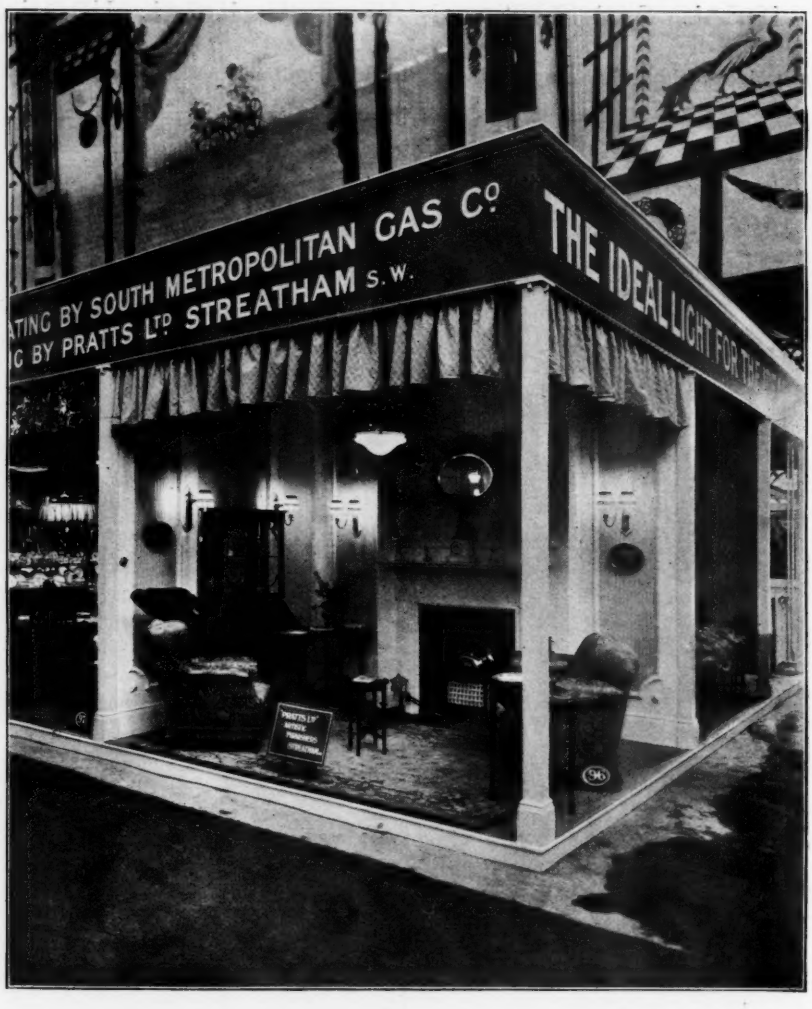


Photo. by Borup, Streatham.

A SECTION OF AN IDEAL LIGHTED AND HEATED DRAWING-ROOM.

gas lighting cannot compete with, or is not equal to, electric lighting in artistic merit. We are not surprised that Mr. Councillor Kay, the Chairman of the Manchester Corporation Gas Committee, and his fellow-members, when they visited the exhibition last Thursday, were loud in their praise of what the Gas Company have done here. The burners used are, of course, of the "Metro" type, in medium and small sizes. The fittings are of oxidized silver and gilt lacquer. Over the bow-fronted counter-desk in front of the stand, there is a piece of metal work, in the form of a pendant, of graceful design and lines, carrying five small gas-burners. There are beautiful standard floor lamps, pendants of all choice descriptions, and bracket lamps on the pillars supporting the roof of the stand. These are not all fitted with "Metro" burners; some of them have candle burners upon them. Modern illuminating agents used with imitation candles may be incongruous; but the public will have them, and in truth, though there appears to be a little straying from the correct order of things in such design of fittings, they are very pretty, supplemented by small and dainty shades. The public taste and requirement have to be studied in business. There are beaded shades, and shades of modern types of the most delicate hues and styles in design—pink shades and lavender-coloured shades predominating—shades that are *petite*, and shades that are ample in their drapery. A bronze figure on a pedestal also supports an inverted burner. We see some of the pendants fitted with the "Metro" lighter. At the bottom of the pendant, or at a convenient place in connection with any other fitting, a small flexible tube is attached, with a silver-plated hand-piece, at the end of which is a hollow containing a small pilot light. With this any number of burners can be promptly lighted up. It is too small to be unsightly; and it does not detract in any way from appearance. It can also be fitted up at the side of the fireplace, and be used for lighting the gas-fire, and as a cigar lighter. Pneumatic switches are also used with other of the pendants. At one corner of the front part of the stand is a Drager ventilating-fan, worked by a little gas-flame—the consumption of gas not being more than ¼ cubic foot per hour. Flying coloured ribbons demonstrate the power of the small instrument. In the division wall between the front and the back part of the stand is a recessed tiled fireplace; and in this stands a "Metro" dog-grate of a design that is equally as effective as is the heating power of the fire.

Hot Water and Other Domestic Uses.

The main stand as indicated is divided into two parts, and here we have various domestic uses of gas illustrated. It may be interpolated here that the scheme of the whole display is to typically demonstrate—true, on a comparatively small scale—all the uses of gas except for street lighting and metallurgical purposes; and it is interesting to see how this is done. The first things that strike one's notice are, fitted in the fireplace, a Potterton and a Stimex hot-water circulator, and a "Metro" cooker. There is a bath in the centre of the stand, demonstrating hot water supply by a Ewart geyser. Alongside the bath is one of Fletcher, Russell, and Co.'s lavatory water-heaters, as well as a "Gem" still for producing distilled water. Then the visitor is shown the use of "Metro" irons, which are being operated by employees of the West-end Laundry Company, of New Kent Road, S.E. A novel demonstration engine is exhibited, by which no doubt is left on the visitor's mind as to the power of gas as a motive agency. It is an extremely interesting little exhibit; and it likewise enjoys an active life under the designation of "Metro." We see one of Ash and Co.'s sterilizing appliances, in which the heating agent is gas. On another part of the stand is a revolving arrangement with a glass panel at top, by which is shown an actual section of a "Metro" burner; and by this the beauty and accuracy of the fitting of the parts can be studied.

This section of the stand is well illuminated by "Metro" burners, attached to less ornate pendants and brackets than are seen on the front portion of the stand, but yet fittings (several of them bronze-finished) which show that, even for less important lighting than dining and drawing rooms, libraries, and so forth, gas-fittings have passed quite away from the old grim-looking style of a quarter of a century ago. Among the lights is a semi-indirect fitting, with the bowl supported by chains.

The whole stand and its fitting are designed in charming taste; and they supply first a direct negative to any allegation that gas as a lighting agent cannot add to the decorativeness and life of a home, and, secondly, material testimony to the utility of gas as a domestic heating agent.

Passing outside, some beautiful ornamental designs of brackets (finished in gilt lacquer) are observed attached to the top part of the stand, and from which brackets depend "Metro" burners

concealed in inverted Holophane shades. Of these there are on each side five single lights, with a double light on the broad pillars at the point of the division of the stand.

Sections of Rooms.

A passage way runs between this main stand of the South Metropolitan Company and a further large sectionized exhibit. This is an extension of the display made last year by the Company; and it is built up on every side of object-lessons. We have seen it demonstrated on the main stand that any house, be it mansion or an establishment of less pretentious degree, can have gas-fittings suitable to the most sumptuous furnishing and the most artistic of decorative circumstances. Here we have demonstrated by sections of rooms that the pretty houses of suburbia and the homes of the artizan can be assisted to ideal conditions in regard to brightness and comfort by the aid of the ever-ready servant—gas. Here immediately facing are sections representing the drawing and dining rooms in (say) a £50 a year suburban house. The furnishing has been carried out by Pratt's Limited, of Streatham; and they have very correctly interpreted what is required in a display of this character. The drawing-room is pretty, and is panelled in quite an inexpensive style; the general treatment being in rose pink and French grey. It shows what a charming effect can be obtained by a happy combination of colours. The room is suffused with soft light. On the walls are shaded candle-lights—two single and two double, with a semi-indirect pendant in the centre. In the green-tiled fire-place, is a "Metro" gas-fire, in green bronze finish; and it demonstrates the excellence of the duty of this type of fire. The dining-room, with its panelled ceiling, is furnished and decorated after the Jacobean period; the treatment being in brown; and, again, we have a charming effect. An ornamental "Surprise" pendant, with two "Metro" burners and a shade, supply light; and set in the brown-tiled fireplace is one of the Company's own fires in brown finish. One of the handy lighters already described is fitted by the side of the fire-place for lighting the fire and making provision for smokers. The support for the lighter is furnished by a fixed ash-tray. It is a very natty and convenient arrangement.

Next there is the artizan's kitchen. The artizan and his wife and family who are in their kitchen furnished with light and heat in the manner here illustrated will be particularly happy. The conditions are not beyond the artizan's attainment. Surveying the scene, there is on one side a dresser, with a willow-pattern dinner service upon it, together with a table, wheel-backed chairs and arm-chairs to correspond. There is a very cosy and cheerful effect here. A single-burnered pendant in the room illustrates that, by the "Metro" burner, and an inexpensive though not inelegant fitting, the artizan can get a splendid light—far different from the days of the old greasy and evil-smelling oil-lamp so frequently found in the artizan's home. On one side of the kitchen in a recess is a gas cooking-stove, and on the other side of the room is a small gas-fire, with a standard service-pipe having a gas-cock at the top. What a marked change from the old order of things! It shows what is possible; and what may be expected to in time become the universal thing in the houses of the poorer (as well as the richer) section of the community. The artizan's sitting-room is another comfortable apartment. It is furnished in dark oak, lighted by a double-burner pendant, and is heated by a "Metro" fire.

What Coke Can Do in the Ideal Home.

On the rear side of this supplementary stand, we have something novel in the way of an exhibition demonstration; and it would be good to have more of the same sort of thing. It is a composite exemplification of what can be done by a coke-heated boiler in supplying hot-water to a kitchen, to a bath, to a lavatory basin, and to radiators in a greenhouse filled with aspidistra. The coke-boiler is in a recess; and the Company have run a flue-pipe from it to outside the building, in order to make by actual work an effective demonstration. Not only does the boiler supply the hot water for all the purposes mentioned, but the heat from the boiler is all that is required for the heating of the kitchen; so that there is true economy in fuel here. A "Metro" gas-cooker keeps the boiler company in the recess. It is a good typical arrangement for a kitchen. There is no doubt about the water being hot, for the attendant shows it running steaming into the bath and lavatory basin, and can give thermometric testimony on the spot, while a hand placed on the radiator in the greenhouse supplies further convincing proof, if this were needed. Several coke-boilers and other coke-heating appliances are on the stand. The boiler at work uses from 4 to 5 lbs. of coke per hour; and it will also burn up the domestic rubbish. Paper bags are shown filled with coke which can be purchased

Photo. by Borup, Streatham.

A SECTION OF AN IDEAL LIGHTED AND HEATED DINING-ROOM.

Photo. by Borup, Streatham.

DEMONSTRATING COKE AS A DOMESTIC FUEL AT THE IDEAL HOME EXHIBITION.

from the Company at 4½d. per bag. This part of the stand is lighted by brackets carrying double and single "Metro" burners.

This completes the description of an excellent demonstration at the Ideal Home Exhibition; and we cannot do less than once more heartily congratulate the South Metropolitan Gas Company upon the attractive result of their magnificent enterprise.

A FEW OTHER EXHIBITS.

There are a few other firms presenting exhibits in which readers of the "JOURNAL" are interested.

R. & A. MAIN, LIMITED.

A small stand is in the occupation of this firm. They would have liked a larger space; but pressure on Olympia's superficial area denied it to them. However, they are showing a fine range of the "D.S.O." fires; but the central feature of the display is the "St. Nicholas" fire, which, having the appearance of a coal-fire, is attracting a great deal of attention on the part of visitors. The "Santa Claus" fire is another novelty which will please, as the interchangeable front enables the stove to be used either as a gas-fire or as a coal-fire. By simple means, the coal-fire bars are taken out; by simple means the gas-fire is set in the grate and connected up; by equally simple means there can be re-conversion. It is all so simple that the householder can exercise with freedom his choice of fuel. There are upon the stand, too, gas-heated steam radiators, grillers, and hot-plates. There is a bachelor's combination set, which embodies a slot meter, stove, towel-rail, and a light over the lot. There are also a Gothic cooker,

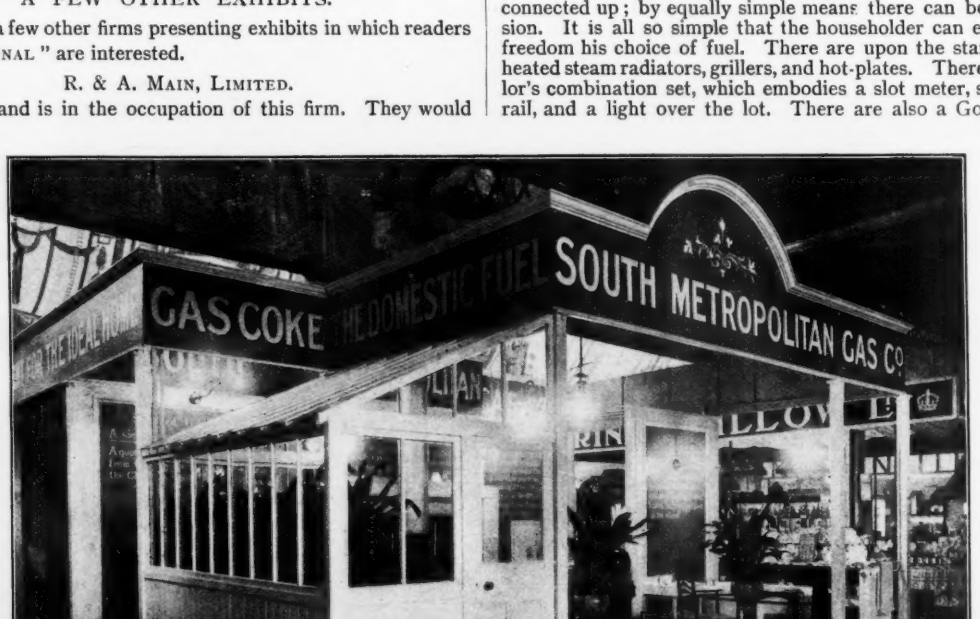


Photo. by Borup, Streatham.

DEMONSTRATING COKE AS A DOMESTIC FUEL AT THE IDEAL HOME EXHIBITION.

with plate-rack, and a large size "Main" cooker—both excellent examples of high-class workmanship.

The Stimex Cooking-Ranges and Water-Boilers.

There is a large amount of interest to be found on the Stimex Gas-Stove Company's stand. There is, for example, the Stimex patent hygienic gas-range, which will completely take the place of an ordinary kitchener. On one side is the gas-oven, with a separate hot chamber for heating plates underneath. On one side of the oven is a gas-fire for warming and airing; and underneath this is a boiler, which will provide a plentiful supply of hot water throughout the house—the cost of a hot bath being calculated at less than ¾d., with gas at 2s. 2d. per 1000 cubic feet. There are also other cookers of various sizes, the capital feature of which is that there are no burners in the oven; and while hot air passes through the oven, the bottom is completely closed. The general construction of the oven is known as the "Stimex hygienic principle." The Stimex Company have also a new water-circulator, constructed so that the boiler can be cleaned with the minimum of trouble. It is mentioned that a material point in this circulator is that it is impossible to have an explosion through the flow-and-return pipes being stopped up. The consumption of gas, we are informed, is very low.

The "Ardor" and "Condor" Gas-Fires.

On the same stand we are introduced to these fires—the inventions of Mr. H. S. Valentine, of Stirling, and made by the Forth and Clyde and Sunnyside Iron Company, Limited. But the Stimex Company are the London agents. What Mr. Valentine has done has been to produce fires of great heating efficiency which can take the place of the ordinary coal-grate, and at the same time ensure that the gas-fire has not the appearance of a makeshift, but of being part of the coal-fire mantel. When inserted in the place of the old wasteful crude method of heating, it looks its part—a perfect modern gas-fire. The fire is made in three sizes; but the intermediate fire—the 12-inch one—is the most popular. The maximum consumption of gas for getting all the fuel perfectly incandescent is 35 to 37 cubic feet per hour; but after the room is warmed up, very satisfactory results are obtained with a consumption of 22 cubic feet. The popularity of the fire is evidenced by the fact that, after last year's Smoke Abatement Exhibition in Glasgow, within seven months some 1100 of this type of fire were sent into the city.

Since the success of the foregoing fire was assured, the patentee has developed the "Condor" inset fire. One of the first features to which attention is drawn is that the back brick is made in two pieces, with horizontal division. The top part being loose offers the great advantage that it can be cut to fit any height of grate. Then, at the side of the fire, there are panels which are adjustable vertically for any height of stove canopy, and which bridge over the gap between the fire and the stove. The fire has adjustable legs for varying the height of the coal-fire bottom grating; also an air-excluding cast-iron front for covering the ash space beneath the coal-fire; gas and air regulators; and, in fact, all that is necessary to ensure efficient results. The heating power of the fires is demonstrated on the Stimex Company's stand; and there is no doubt regarding their heating efficiency.

G. Hands and Co.

We have previously described the "Vitreosil" portable gas-radiators of the above-named firm, with their art metal-work casings, incorruptible "Vitreosil" tubes, ingenious internal arrangements for baffling the heat in the tubes in order to get the maximum radiation from them, and other good features. This is the most novel form of gas-radiator on the market, and the nearest approach to the electric radiator in appearance, but not in heating efficiency. Several electric radiators would be required to counterbalance the heating effects of one of these gas-radiators. There are quite a number of new forms now on the market; and some of them are shown on this stand. The finish has been much improved. Certain of the radiators are made to fit flush into any fireplace; and they are also being supplied with mantel pieces and tiles complete. The construction has been altered in slight details, in order to increase the radiating power, which is stated to be now up to about 70 per cent. There are several other features, which the visitor will find it worth his while to inquire into.

The John Wright "B.T.U." Boiler.

At the stand of the Eagle Range Company is seen one of the "B.T.U." hot-water circulators manufactured by Messrs. John Wright and Co. This is a new boiler, designed with an automatically controlled bunsen burner; and it can readily be connected up to the hot-water apparatus already existing in the house. It is made in three pieces, has a large manlid which permits of the interior of the boiler being easily cleaned. When the gas is full on, the consumption is at the rate of 40 cubic feet per hour; but, with a thermostat fixed, the consumption is trifling during the idle hours. It is a very neat and compact boiler, and cheap. In the case of the exhibit, it is shown connected to a kitchen coal-range, with all connections complete. Being made of cast iron, it should be, from the maintenance point of view, an ideal boiler.

Thomas Potterton.

On the stand of Mr. Thomas Potterton there are shown numerous examples of his hot-water circulating boilers, which are so popular. There are also seen the "Sealed" oven and other cooking-ranges. A special article, for which the exhibits have been used as the groundwork, appears on pp. 136-7, so that nothing further need be written here.

Ewart and Son, Limited.

This firm are making a good show of their gas water-heating apparatus. A central feature is a complete bathroom, with some exclusive features, which show the "Ewart" method and finish. There is a plunge bath of unique shape and remarkable finish—porcelain enamelled with a beautiful surface—a suite of lavatory basins, and a fine selection of nickel-plated bathroom accessories. Quite a new feature, and one which will attract a good deal of attention, is a child's bath fitted complete with its own water-heating apparatus, hot and cold spray, and necessary toilet requisites for towels, sponge, soap, &c. Experience has shown that children, particularly infants, cannot with safety be put in the ordinary full-size bath; and this combination, with the hot-water service supplied to the bath from an "Elite" geyser, will be found most useful. The hot water in the bathroom is provided from one of Ewart's No. 45 "B" pattern "Califonts," which supplies hot water to all the fitments instantly on the turning-on of the hot-water tap. It is noticed that the gas under this heater is only full on while hot water is running; the gas being lowered to a pilot-light simultaneously with the closing of the hot-water tap. The "Califont" is certainly a great improvement in water-heating, as it provides instantly, at the smallest cost, a hot-water service to any number of taps. The "Brilliant" geyser fitted over one of the lavatory basins is quite a novelty. It is safe in use, automatic, and gives hot water instantly on turning the tap. With such an arrangement, no lavatory basin need be supplied with cold water only. A noticeable feature in the bathroom is the special design of mirrors, which are inexpensive and very attractive. A novelty is shown in the Ewart hot-water towel-rail heated by gas. By a small gas-flame, the towel-rail is heated very quickly, and independently of all other services; and, while drying or airing bath towels, it also takes the chill off the room. A variety of water-heaters is exhibited, providing either hot or boiling water to meet all requirements. A similar machine to the "Califont," but of smaller heating capacity, is the "Supreme," which, however, is quite large enough for the ordinary bath. It heats 3 gallons per minute. In connection with the heating of halls, garages, &c., by hot-water radiators, an example of the "Radion" circulator is exhibited. It may be easily installed, and quickly heats-up the hot-water system, maintaining an even, steady heat, and dispensing with the ordinary dust and dirt, as well as with the personal attention that is, of course, required when using a coal-fire boiler.

Thomas Chapman and Co.

This firm is showing the "Record" water-heater (Hammond's patent), which claims many merits superior to all other geysers. Whether it is so or not, there has been no opportunity of testing. One of the principal claims is that the geyser requires no flue-outlet, on account first of the large proportion of air that is supplied to the gas, which produces complete combustion, and, secondly, on account of a hollow ball at the top, into which the products strike, and anything that may be deleterious is said to be brought down by the condensation formed by the combustion of the gas. With all the assurance given, we should prefer the flue-outlet pipe in a bath-room, the ventilation of which might accidentally be completely closed. The combustion of gas, however complete, produces carbon dioxide; and gas burning at the rate of 80 cubic feet per hour would not give off a negligible quantity. If the room is efficiently ventilated, all well and good; but unless there was positive assurance of good ventilation, then give us a flue-pipe, even to the "Record" heater.

Harris Gas-Stove Company.

This Company have a display of gas-cookers, including the "Gorilla" cooker, embodied in which is a hot-water circulator. There is also the "Gorilla" gas griller and toaster, and various other forms of stoves and ovens.

The "Altheat" Gas-Stove.

At the stand of this Company, we have brought to notice a combined gas stove and radiator, by which it is claimed that a large room can be heated at an expenditure of only 10 cubic feet of gas per hour.

Among other exhibitors are Messrs. James Scott and Co. The stand of Messrs. Davis, Bennett, and Co., it is noticed, is lighted by Keith high-pressure lamps. There are also various petrol air gas exhibitors.

POTTERTON BOILERS AND COOKERS FOR DOMESTIC AND OTHER USE.

At the Ideal Home Exhibition and Elsewhere.

A VERY practical display of gas-heating apparatus for cooking and for hot-water supply is being made by Mr. Thomas Potterton, of Balham, S.W., at a stand in the Ideal Home Exhibition. In fact, on the stand may be seen equipment for all classes of dwellings and other buildings, which goes to show that the householder or restaurant keeper of small means can enjoy certain conveniences which add to the pleasure of life equally with the householder or the large hotel keeper. An inspection of what is to be seen on the stand should not be missed.

One of the first exhibits to attract notice is a working example of cooking and water-heating apparatus with a 36-inch "Queen" combined gas and coal range. This is fitted with complete water circulation, comprising 20-gallon jacketed hot-water cylinder, with patent cut-out arrangement; the supply being carried to a sink for demonstration. Then there are working examples of gas-heated hot-water supply systems, with No. 9 "Victor" and No. 21 "Victor" complete apparatus. These supply hot water to a sink and for bath purposes, being operated automatically by the use of thermostats. Both these appliances are of suitable size for small villa residences—the No. 9 being on the usual separate cylinder principle, with the boiler fixed beneath; and the No. 21 apparatus, on the new combined system, with boiler and cylinder in one.

Then there is a complete model of a combination gas and coal heated hot-water supply system for large house, hotel, or restaurant purposes, having twin No. 20 "Victor" boilers operating a 50-gallon cylinder in conjunction with a double-oven kitchen range. There is also the "Queen" combined gas and coal kitchener with double ovens. In this we have a perfectly equipped range which can be used with either fuel; and it is obvious that every detail necessary to its general utility and completeness has been carefully considered. As a gas-range, it has an important adjunct in the "Victor" boiler, which provides hot water for domestic supply when the coal fire is out of use.

"Victor" boilers, in various designs, are also exhibited, including the "D" series vertical type (Nos. 18, 19, and 20), the "B" and "C" series horizontal type (Nos. 12, 13, and 17), also a new model, No. 30 "E" series. A special feature of the "D" series is their extreme flexibility of design; being so arranged that the connections can be made either for high or low return, according to the requirements to be met. A further important feature is their convenience for multiplying connections where duplicate or triplicate flow-and-return circuits are necessary, as in many hot-water radiator jobs. This advantage, we are given to understand, is possessed exclusively by the "Victor" boilers.

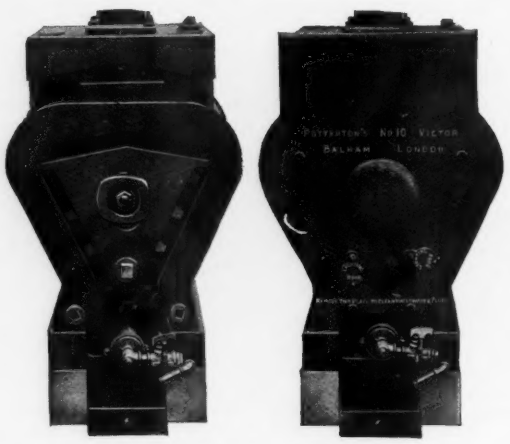
The new "Sealed" oven cookers form an important item on the stand. These, as our readers are aware, differ from the the ordinary gas-cooker in having the gas-jets enclosed in chambers sealed within the oven. The cooker embodies more than the advantages that are claimed for electric-cookers, and at considerably less cost for fuel; and, moreover, it can be supplied in various forms with water-pads for hot-water supply.

Samples of radiators for central heating by hot-water circulation are also shown, as well as towel dryers for bathroom and lavatory purposes. To exemplify various installations, diagrams of domestic supply apparatus executed or in progress are shown, and will be of interest to all gas men visiting the exhibition.

On both stands of the South Metropolitan Gas Company the "Victor" gas-heated appliances are fitted; the large stand having a system of hot-water supply in operation, with a No. 11 size "Victor" hot-water apparatus of 34 gallons storage (jacketed), a No. 20 boiler, thermostat, and the other usual accessories—the plant supplying hot water at the bath for the purpose of general demonstration. A separate system for warming purposes with radiators (heated by No. 19 "Victor" boiler) is also fitted on the Company's stand; the piping scheme being arranged upon Potterton's high-return system, in which both the flow-and-return pipes are carried overhead to clear doorways. This is an arrangement that must be of great advantage in flats, offices, &c., where circuits cannot be returned on the floor-level. An example of a coke stove and boiler forms an adjunct to the South Metropolitan Gas Company's exhibit. For this Mr. Potterton designed and installed a combined system of warming for rooms and greenhouse in connection with general domestic supply for baths. This also is in operation, and is an instructive sample of an efficient scheme where coke-heaters are required.

THE NO. 10 "VICTOR" BOILER.

Returning to Mr. Potterton's own stand, there are seen samples of the No. 10 "Victor" boiler for general household use. These are boilers of a remarkably high efficiency. The illustrations show some of the details of construction. It will be noticed that the boiler has three water-ways one above the other. From figures that are being distributed regarding the results of a test, it is observed that the temperature of the flue products is much lower than that of the water leaving the boiler: Water leaving boiler 153°, flue products 123°. In using the boiler as a geyser, the temperature of the water leaving the boiler is 162°, with a flue temperature of 120°. It is found, however, that unless the



Detail of No. 10 "Victor" Boiler.

kitchen fire is working, the flue products, being so low, condense and drip on to the top of the range; the flue products being in cold weather as low as 100°. Therefore, the No. 10 boiler should only be installed to assist the kitchen fire, the heat of which overcomes the condensation trouble in the chimney. Movable condensation trays are required under this boiler. Of course No. 20 "Victor" and all the other boilers are installed to work with or without the kitchen fire, and do not require condensation trays.

With this boiler in the tests 70 cubic feet of gas gave results equal to four baths of 20 gallons at 104°, after allowing for heat losses in uncovered boiler, cylinder, and piping, which losses must be considerable.

Test of No. 10 "Victor" Boiler, burning a Given Quantity of Gas, drawing Hot Water, taking Temperatures of the Hottest available for Sink Purposes, and Larger Quantities for Bath.

Temperature of Water 65° Fahr.

	Time.	Flow.	Flue.	Gas. Cub. Ft.
Gas lighted	9.15	65°	—	—
	9.20	87	92°	6½
	9.25	130	110	13
	9.30	140	112	19
	9.35	148	120	25

25 *cub. ft. gas consumed.*

20 gals. of water run off into measuring-tank.

	Tap.	Bulk.	
5 gals.	140°	127°	Hottest water, 143°
10 gals.	113	129	
15 gals.	90	118	
20 gals.	87	109 = 352 B.T.U. per ft. of gas.	

	Time.	Flow.	Flue.	Gas. Cub. Ft.
Continuing	9.45	148°	120°	38½
	9 50	154	124	45

20 *cub. ft. gas consumed.*

20 gals. of water run off into measuring-tank.

	Tap.	Bulk.	
5 gals.	149°	133°	Hottest water, 150°
10 gals.	110	133	
15 gals.	90	120	
20 gals.	87	110 = 450 B.T.U. per ft. of gas.	

	Time.	Flow.	Flue.	Gas. Cub. Ft.
Continuing	10.0	145°	123°	58½
	10.5	153	123	65

20 *cub. ft. gas consumed.*

20 gals. of water run off into measuring-tank.

	Tap.	Bulk.	
5 gals.	149°	135°	Hottest water, 151°
10 gals.	113	132	
15 gals.	89	120	
20 gals.	87	110 = 450 B.T.U. per ft. of gas.	

Gas burnt while drawing water, 5ft. (70 ft. in all).

Residue 30 minutes later, 20 gals. at 87°.

Test of No. 10 "Victor" Boiler Used as a Geyser.

Temperature of water, 65°.
Room temperature of atmosphere, 63°.
Water running at 38 gallons per hour.
Gas consumption, 80 cubic feet per hour.

	Time.	Flow.	Flue.
Gas lighted	10.0	—	—
	10.10	124°	112°
	10.20	148	118
	10.30	156	120
	10.40	160	120
	10.50	161	120
	11.0	162	120
	11.10	162	120
	11.20	162	120
	11.30	162	120
	11.40	162	120 = 460·75 B.T.U. per ft. of gas.
	11.40	Gas reduced to 59 cubic feet per hour.	

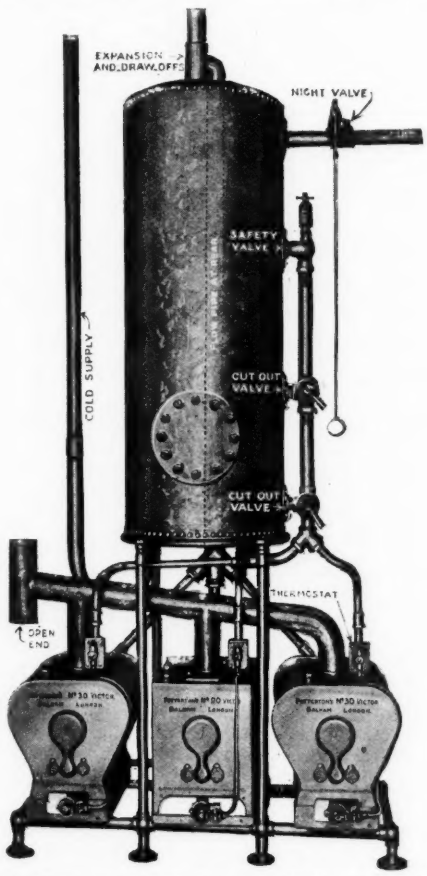
Time.	Flow.	Flue.
11.50	148°	108°
12.0	140	106
12.10	140	106
12.20	140	107
12.30	140	107
12.40	140	107 = 483 B.T.U. per ft. of gas.
12.45	Gas reduced to 40 cub. ft. per hour.	

Time.	Flow.	Flue.
12.50	128°	97°
1 0	121	93
1.10	118	92
1.20	118	92
1.30	118	92 = 503·5 B.T.U. per ft. of gas.

The condensation in movable tray after making this test amounted to 5½ lbs. water.

A HOSPITAL BOILER AT SHEPHERD'S BUSH.

While dealing with Mr. Potterton's exhibits at the Ideal Home Exhibition, we may illustrate the installation that he has fitted up in the hospital section of the National Gas Exhibition. It will be remembered that this working exhibit comprises three Potterton "Victor" boilers (the two outside ones being No. 30 type and the middle one No. 20 type) arranged upon the battery system in



Installation in the Hospital Section at the National Gas Exhibition.

conjunction with a cylinder of 100 gallons capacity. The boilers, being situated below the storage, are fitted with high returns forming "cold-top" sections (or "C" pattern connections); thus reducing the heat loss by radiation and maintaining low flue temperatures. Thermostats are fitted to each boiler, two of which have bunsen burners, and the third luminous ones, either of which can be supplied according to preference. The installation is fully equipped with both primary and secondary circulations; the former being arranged with cut-out valves to operate the storage in three sections—thus heating one-third, two-thirds, or the whole of the contents of the cylinder proportionately to the varying requirements and proportionately to the capacity of either one, two, or three boilers, which can be used accordingly. Other details of this very interesting installation will be found in the course of our general notice of the National Gas Exhibition (see "JOURNAL" for Sept. 30, p. 909).

Odessa Gas Supply Concession.—The "Journal für Gasbeleuchtung" of the 11th inst. reports that a contract has been signed, after approval by the Russian Government, between the Corporation of Odessa and the German Continental Gas Company, by which the latter take over the Corporation Gas-Works, and obtain a concession for the supply of gas to the city for a term of 35 years. The competition for the concession is reported to have been very keen.

WORKMEN'S COMPENSATION STATISTICS.

MATERIAL for a general review of the working of the Compensation Act of 1906 in relation to the main body of the industries of the United Kingdom, is again provided by the Home Office Blue-Book of Statistics relating to the Workmen's Compensation Act and the Employers' Liability Act—the issue of which for 1912 has recently been published.

The returns, which bear the signature of Sir Edward Troup, have been collected from the seven great groups of industries—mines, quarries, railways, factories, harbours and docks, constructional works, and shipping. In these groups, the number of employers included in the returns was 136,279; and the aggregate number of persons employed coming within the provisions of the Compensation Act was nearly 7½ millions, of whom more than 5 millions came under the heading of "factories." In the industries referred to, in 1912, compensation was paid in 3599 cases of death, and in 424,406 cases of disablement; the average payment in case of death being £158, and in case of disablement £6 3s. The annual charge for compensation, taking the seven groups of industries together, averaged 8s. 7d. per person employed. Factories were the lowest, with 5s. per person; while mines were at the top of the list, with 21s. 10d. For quarries, the amount was 11s. 3d. per person; for constructional work, 11s. 7d. It is pointed out that in the coal-mining industry the charge arising under the Compensation Act works out at only 1·05d. per ton of coal raised.

The total amount of compensation paid under the Act in the seven groups of industries during the year was £3,174,101, compared with £3,056,404 for the preceding twelve months. It is estimated that when to this is added the costs of management, commission, legal and medical expenses, &c., the total charge borne by the seven industries probably amounts to nearly £5,000,000. The figures quoted embrace, in addition to accidents, cases of the various industrial diseases (now twenty-four in number) included under the Workmen's Compensation Act. In the seven groups of industries, compensation was paid in 55 cases of death from disease, and in 6712 cases of disablement. The bulk of these cases—in fact, 87·9 per cent. of the total—occurred in the mining industry; of the remainder, 606 were cases of lead poisoning.

Statistics for the seven industries named are now available for a period of five years; and in this time there has been a large increase in the compensation charge—attributable, however, almost wholly to disablement cases. In 1908, compensation was paid in 3473 fatal cases to the amount of £536,123, and in 325,484 disablement cases to the extent of £1,544,549; whereas in 1912 compensation was paid in 3599 fatal cases to the amount of £567,107, and in 424,406 disablement cases to the extent of £2,606,994. Thus while the fatal cases have increased only 3·6 per cent., and the amount of compensation for them by 5·7 per cent., the number of disablement cases has gone up 30 per cent., and the amount of compensation for them has risen 68 per cent. The increase, it is remarked, has been steady throughout the five years. It is thought that the increase in the number of cases is in part due to the fact that the remedies provided by the Act have become better known and more fully used, though to a large degree it must have been owing to expansion of trade, which, of course, means the employment of more men and longer working hours. To what extent these causes really account for the increase, or how far it is due to improper claims or to malingering, cannot, the report says, be gauged.

With regard to the returns of accidents in mines last year, the total number of persons employed is given as 1,086,113; and there were 1246 fatal accidents, and 167,959 cases of disablement. The compensation paid in respect of the former was £202,367, and of the latter £897,090. Of industrial disease, there were two fatal cases, and 5949 instances of disablement; the compensation amounts being respectively £439 and £85,831. Thus the amount of compensation paid in this industry last year was £1,185,727, compared with £1,255,223 in 1911. In connection with the figures quoted, the national strike of miners last year, and its period of idleness, must be borne in mind. The average compensation per case of disablement was £5 6s.

As to the duration of compensation for accidents generally, there is a table included in the report which shows that cases lasting two weeks and less than three weeks accounted for 31·9 per cent. of the total number; and cases lasting four weeks and less than thirteen weeks, for 35·19 per cent.

The Blue-Book also contains statistics relating to proceedings in the Courts; and these show that only a very small proportion of the claims under the Act become the subject of litigation. The total number of cases under the Compensation Act which were taken into Court last year was 10,972. But many of these were applications for dealing with allowances that had already been granted, and many were settled out of Court or otherwise disposed of; so that the total number of original claims for compensation in the United Kingdom finally settled within the cognizance of the Courts was only 5858. Of these, the decision was in favour of the workman in 4455 cases, or 76 per cent. Proceedings in Court under the Employers' Liability Act continue steadily to decrease; the number of cases having fallen from 604 in 1907 to 197 last year.

ELECTRICITY SUPPLY MEMORANDA.

A NUMBER of electricians have been to the National Gas Exhibition. It has been a pleasure to see some there whose countenances are not altogether unknown to us. Some of them were up quite early to see what the gas people were doing in the way of this collective display; and they were in evidence before the fitting-up of the place was really complete. It is hoped that those electricians who were there betimes will go again, and inspect the place in its finished condition. It is agreed by certain electrical contemporaries that, even for electricians, there is in these exhibition halls much for them to learn. More than one electrician to our knowledge has already been persuaded by the exhibition that in the gas industry there is a much stronger competitor than was imagined to be the case. Yet the gas industry does not want—notwithstanding the silly and cynical remarks of one or two electrical contemporaries—to look upon the exhibition as in any sense whatever *anti*-electric, but simply *pro*-gas. This was the apt expression of the President of the Exhibition (Sir Corbet Woodall, D.Sc.) on the opening day; so that right away from the first, the electrical industry was invited to regard the display in the proper light. Certain are we of this, from what has been seen and heard in the exhibition, that some of our electrical friends have been forcibly struck by the gigantic strides made in the art of using gas for lighting purposes, and by the wonderful ramifications of the business in gas for its heating qualities. Seen one evening were two or three electrical men gazing, before entering the halls, at the Keith lamps with their silica cups round the mantles. There was no amused expression on their faces. Inside the entrance hall, there was visible astonishment as they saw the suspended works of art, by Sugg, with the concealed gas-burners. The visitors were not followed; but we undertake to say they were equally surprised with the samples of semi-indirect fittings in various parts of the halls, as well as the beautiful artistic fittings—such as the shaded candle lights—all on the same plane as the very best that they have to offer. Added to this, the improvements that have been effected in switching arrangements, the lower intrinsic brilliancy of gas-lights than electric lights, the nearer approach of the former than the latter to the spectrum composition of sunlight, and the amount of light that the gas industry can supply for a given price, and our electrical friends must see that their competitors are stronger than their (on these subjects) ill-informed channels of intelligence had led them to suppose was the case.

Electricians at the Gas Exhibition.

It is perfectly true that in the vast exhibition there may be a few odd points that are open to criticism. Good lights may be attached to poor looking pendants in one of the halls, a lamp that does not harmonize with its pendant may be found, a couple of large inverted lamps may be suspended over a bed where smaller units fixed a little higher up would be preferable, and an inverted burner here and there without shields on the top may be parting with their heat directly on to certain exquisite fittings which will do them no good. But the man would be hypercritical indeed who made much of any little discoverable blemishes of this kind (which can be rectified) with such an immense display of what is good in the exhibition. What there is in the way of fittings for lighting purposes does not by any means exhaust, even typically, the vast range of works of art with which our gas-fitting makers now supply their customers. One or two samples of the more noble looking fittings that have been seen in certain show-rooms might well have found place in open parts of the display, where they would have been bound to attract admiration, and at the same time would have dispensed with some of the more ordinary fittings and lamps, of which there is such profusion. But the organizers have had an eye on the demonstration of utility, and conformity between environment and fittings. There is one other point on which criticism has been heard; and it is that, on entering the street-lighting section, the first low-power low-pressure lamps that we meet with are not impressive. It is a vast place to illuminate; and the first impressions from the first lamps are not good under the circumstances of demonstration. It would perhaps have been preferable to have had a scheme, now that we see the effect, that started with high-pressure high-power lights, followed by lamps of gradually diminishing candle-power down to the smallest units at the very rear of the hall. However, it is easy to be wise after the event. But this is the feeling that one gets after a survey of the street lighting, though it is recognized that there is reason in the present scheme—in having high-power lamps of 2000 and 1000 candle power in the centre of the hall, with lamps diminishing in candle-power at either end. However, these matters are mentioned here because the most critical of the visitors to the show will naturally be our electrical friends.

Occasional Inconsistency.

There are other points upon which a few observations may be made that are particularly pertinent to the attitude adopted by the electrical industry towards the gas industry. The exhibition will, we think, convict, in the eyes of all reasonable electrical men, those in their midst who, despite the ever-increasing business of the gas industry, adopt as their commercial war cry, "Gas must go," and other idiotic expressions of the kind. Gas has a large field in which it contributes to the well-being and economy of the country in a manner that is impossible in the case of the electricity industry; and the attitude of the electricians whom we have in mind is altogether reactionary, and, being reactionary, is, to speak mildly, extremely foolish. Gas can serve, and is serving, industry in a manner with which electricity suppliers cannot compete; and its contribution to manufacturing efficiency is a growing business with the gas industry. Gas is ministering to the needs of the masses, in more ways than lighting, in a manner with which the electrical industry cannot compete. Its range of appliances for culinary purposes, from the boiling-ring to the oven in which (as one cynical contemporary puts it) an ox can be roasted, presents a range of utility with which the heating properties of electricity cannot vie. The range of facilities provided by the gas industry for water-heating is a matter that we know has struck many an electrical engineer who has visited the exhibition. This popular method of quickly supplying hot water in small quantities and in bulk, and the big extent of the applications of the hot water for house and factory warming, spray and other baths, besides for numerous domestic, industrial, hotel, club, and other purposes, together with the provision of steam in the kitchens of the public caterer, all constitute a striking demonstration. There are estates of which we know that are being developed at the present time, and in the houses on which provision is being made for lighting both by gas and electricity, but in which arrangements are only being made for cooking and hot water supply by gas, while the house heating is left to gas or coal according to the fancy of the tenants. The contribution that this gas work is making to the comfort and convenience of the community, and to the greater purity of the atmosphere, is all to the universal good. Against it all we hear the imbecile squeak of certain hare-brained electricians—"Gas must go." For what purpose—the sole benefit of the electrical industry, and the complete disadvantage of the community and industry? The community and industry are the final arbiters; and the expansion of the business and service of the gas industry is significant of their decision.

Beneficent Service.

While submitting that illuminating engineers have been doing a good work in cultivating a higher scientific consideration of the subject of illumination, and educating the people as to the bad effects of lights of high intrinsic brilliancy, and of marked spectrum divergencies from daylight, together with the bad effect that certain lights have more than others in the judging of colours, we are disposed to agree with the "Electrical Times" that we can have in artificial lighting too much of the efficiency which is rigorously standardized by foot-candles or watts per unit of surface. Our contemporary raises the point in connection with a paper, by Mr. Herbert E. Ives, which has been published in the bulletin of the Illuminating Engineering Society of America. Mr. Ives contends that illuminating engineering is, in domestic lighting, discarding artistic effects in order to gain the efficiency that their narrow standards impose. There is not the slightest need in illumination to be puritanically stern. The chief points, in Mr. Ives' opinion, to be aimed at are diffusion, proper direction, freedom from excessive contrast and glare, a pleasant non-fatiguing quality, and good appearance. We are prepared in the gas industry to comply with these points, as well as to meet the really "vital" ones in illumination. He alleges that the illuminating engineer measures factors that are not the ones that are really vital. We are not prepared to go quite so far as that, because we do think that one of the vital points is to have a sufficiency of illumination for all purposes, and "all purposes" embrace such a variety that one volume of illumination cannot be prescribed to suit them all. This is a vital point; and still more vital points are intrinsic brilliancy and quality in respect of the composition of light, seeing that these have physiological effects which are both of individual and national importance. Mr. Ives prefers large sources of light of low intrinsic brilliancy; and he sets out to obtain what he requires by means external to the source of lighting itself. Now we submit that, if he takes a source of light, such as the incandescent mantle, which is so much greater in area for a given candle power than (say) that of a metallic filament, he would start at the very beginning—that is to say, at the source itself—in gaining what he desires; and this he would find would be a considerable step towards realizing diffusion, a reduction of excessive contrasts and glare, and the lessened eye-fatiguing quality of light. Generally, he lays it down as an axiom that "any system by which the light source is the brightest visible thing gives an extreme brightness ratio which is too great to wear well." There is in the tail-end of this a little bit of metaphor that is attractive.

Illumination Effects.

From the argument of Mr. Ives, we draw the deduction that something in the nature of a semi-indirect system of lighting best meets his views. He does not like indirect lighting, for the bright ceiling and the subdued light below make him feel that he is down a well. Another objection is that the vertical lighting is intensified, and horizontal illumination from the walls is altogether annulled. This is distinctly contrary to what we are accustomed

Effective Illumination.

to in the lighting of rooms during daylight hours. Light sweeps in through vertically placed windows in a diagonal direction, the shadows are long and sweeping, and the contrasts are not great. If we have indirect-lighting near to the ceiling, we promote the exact opposites of everything that obtains in a room during daylight hours. Therefore, with an indirect lighting system, it would be well to drop the source of light a little, so as to get reflection not only from the ceiling, but from the upper part of the vertical walls of the room. With a translucent bowl, giving semi-indirect illumination, the defect of vertical and no horizontal illumination is, of course, overcome. Mr. Ives experimentally tried a yellow Japanase umbrella of oiled paper, with the convex side up, suspended beneath a source of light; and this had the good effect of obtaining a better general illumination by reflecting the light partly to the ceiling and partly to the walls and to the pictures upon the walls. The only defect was that anyone sitting at a distance from the source of light still had the light visible to his eyes. On the other hand, the only disadvantage of the semi-indirect system is that the upturned bowl is still the brightest object in the room; but we cannot see that this is any great drawback, in view of the low intrinsic brightness. We incline to the view that in this system we have the best possible method. By artificial means it cannot be hoped to secure the same effects as are produced by Nature. By semi-indirect fittings, good effects are obtained without monotony.

Moderate Means to be Catered for.

It is quite true that in our best homes what is required is decorativeness combined with efficiency. But, forsooth, in some houses that have been treated electrically by "experts," we have noticed how difficult it has been to read with comfort, owing to the meagreness of the illumination. That is inefficiency. Efficiency has there been sacrificed to decorativeness. In considering the question of decorativeness and efficiency, however, it must be remembered that probably 80 per cent. of the householders of the country have not the incomes with which they can gratify desires for the highest pitch of artistic fittings, and have perforce to be quite content to obtain good illumination at a moderate expense. For room lighting a simple translucent bowl with chains for suspension ought not to be a very costly thing; and, with an inverted burner over the bowl, no globes are required for ordinary room lighting. Maintenance under such circumstances would be very modest. The general result would be decorative and efficient. Pushing some low-priced fittings of this style among gas consumers in residential districts, would soon advertise them, and help to create a new desire and a new demand. A fresh order of things would then steadily spread itself over the scene of domestic gas illumination.

Powder and Shot.

With this suggestive heading, the "Electrical Review" the other day referred to an accident in which gas was concerned. Our contemporary did not suggest that the following incidents published the same week might be useful as powder and shot to the gas industry. On Sept. 26, a labourer engaged on the new sea defence at Southend-on-Sea attempted to pick up a live electric wire that had fallen from a post, and was instantly killed. In the Broomrig pit of the Banknoch Coal Company a pit fireman last month was killed through electric shock while extending the cable of a coal-cutting machine. The "Review" publishes the information that the fire which recently broke out on the *Imperator* while lying in New York Harbour is reported, by the Hamburg-American Company, to have been due to a short-circuit in one of the electric motors used to drive the air-cooling plant. The destruction by fire of Earl Guildford's mansion—Waldershare Park, near Dover—early on the morning of the 1st inst., is attributed to a lighted candle having been left in the rafters above a room in which the electric light was being installed. The fire was not discovered until after midnight. It is not stated by the newspapers how long before this the alleged careless man quitted work, nor is information given as to the length of the candle that he is supposed to have left alight among the rafters, nor as to whether the workman has been found who confesses that he is the person who forgot to extinguish the candle.

WORKS TOPICS.—II.

By "Modus Operandi."

Some gas engineers have recently been agitating themselves on the question of the innumerable patterns of retort sections in use at different works. It is suggested that the shapes should all be standardized. There is something to be said for this view, but one would think that it is not so much for the gas engineer to complain as the retort manufacturer. The former settles on a section that suits himself, and, for obvious reasons, he is limited to this particular section until additional settings are required, or the mouthpieces are worn out—unless, of course, he considers it advisable to scrap the mouthpieces to enable him to adopt a more suitable shape. As the life of a mouthpiece may be anything from ten to twenty years, the choice of a retort section is a matter of some moment. The writer, however, fails to see that the question of standardization matters one jot to the gas engineer. What interest is it to A that B should have the same section? It would be more to the point if the makers were to approach engineers with a view to inducing them to adopt the use of certain sections only. It would probably be a great advantage to the retort manufacturers to limit the variety of sections. But let them express their views and state what inducements they can offer in £ *s. d.* to gas engineers to scrap their mouthpieces and adopt a standardized section. If the latter were offered at 3s. 9d. a foot, and special sections at 4s., we should then see a fairly universal adoption of standardized retorts. But if, on the other hand, no economies will accrue to the retort maker, and, through him, to the user, why this agitation?

No engineer who has had any length of experience of heavy charges will deny the fact that the discharge of coke from old retorts is a matter of the greatest difficulty. If only the shape could be kept uniform throughout their life, there would be no trouble—except for a few days after scurfing. But so soon as the shape becomes uneven, the trouble commences. Some old retorts will take a quarter of an hour to discharge, and then only after much elbow grease has been applied in digging out the coke—or rather breeze, as it would better be termed, after the treatment it has received from the continual ramming of the pusher and the blows from iron bars. This trouble is mostly in evidence in gas-works where unsuitable shapes of retorts are in use, and where five tiers of retorts are used in the settings. Retorts set in three tiers do not settle so much, nor become so uneven as the top tiers (and particularly the two top tiers) in settings in which five tiers are used. There is obviously in the case of the latter a greater margin for sinking. It is not unreasonable that a body of coke practically filling the retort should get out of line when being pushed through an uneven tubular vessel, rough in parts and varying in size every few feet. Such rough material as coke obviously accentuates this tendency.

This being so, it behoves gas engineers, and more particularly those who are now working, or intend to work, heavy charges, to give close attention to this question of retort shape. The desideratum is a retort that is strong in itself, that is to a large extent self-supporting, and that does not depend so vitally on closely-placed cross-walls; and, further, a shape of retort that does not prevent any upward lifting of the body of coke when being discharged. A little play must be given to the mass of coke on its removal. The shapes of retorts that most nearly fulfil the above essential factors are, in order of merit:

1. The oval section of good height but limited width.
2. The round section.
3. The oval ⌂

All other sections are, in the writer's opinion, unsuitable for heavy charges, for the reason that they are not in any sense self-supporting over more than a very few inches, and are, further, of such a shape as to prevent any upward movement of the charge on its removal. Some sections of ⌂ retorts are, in this latter respect, much worse than others. Those which taper considerably on the sides, similar to the exaggerated shape shown in fig. 1, are those to which reference is particularly intended. In such a retort the charge is virtually dovetailed into the retort, and it is not very surprising that it becomes jammed. Retorts that have straight sides, similar to the section usually adopted with Fiddes-Aldridge machines (such as shown in fig. 2) are better in this respect, but are weak at the corners, and are in no sense self-supporting—the radius being small and the flat bottom of the retort weak and very liable to become misshapen. All flat-bottomed ⌂ retorts are equally deficient in this respect. The oval section on the other hand, if used as suggested, will be (say) 21 in. wide by 18 in. high, or in those proportions; it will allow a little latitude for the lifting of the charge; and, what is of more importance, it will be in itself of great strength. The big radius on the bottom, being an inverted arch, will enable it to withstand any tendency to come uneven. This section of retort will be much more independent of closely-placed cross-walls, while the radius on the top will enable it to resist any tendency to sag at this point. The oval retort is, further, much more easily filled with coal by machines of the projector type than is the ⌂ retort. The curved bottom and outward-tapering sides are undoubtedly important factors for this purpose.

Fig. 1.

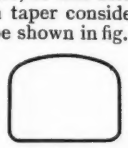


Fig. 2.

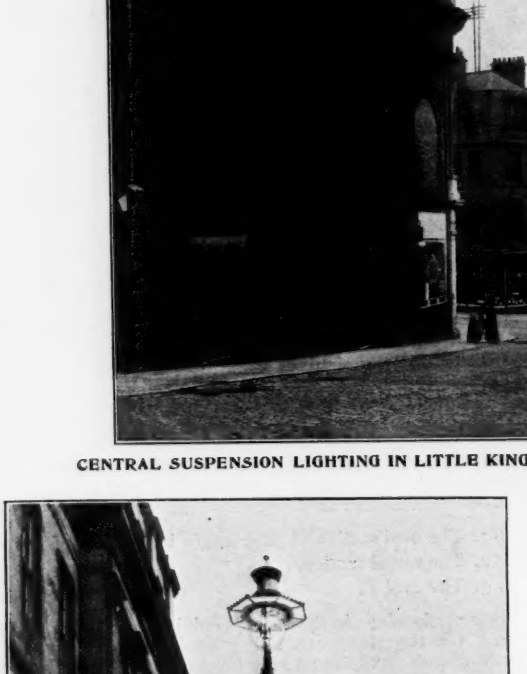
The round retort has much the same advantages as the oval retort, but experience is wanting. Further, the shape does not lend itself to satisfactory grouping in a setting which is so constructed as to require retorts of greater width than depth. A round retort would leave too much space for the combustion chamber and side flues, unless a special arch was designed for its use. Even then a narrow setting would mean a narrow furnace and a limited space for regenerators—two important points. The oval ⌂ is much better than the flat-bottomed ⌂ retort, but has not the advantages of the oval section.

The heavy charge has so many important advantages that it is particularly desirable that the undoubted difficulty of working with old retorts should be minimized as much as possible, by adopting the type of retort most suitable for this class of work.

HIGH-PRESSURE LIGHTING IN EDINBURGH.

By way of demonstrating the possibilities of lighting by high-pressure gas, the Edinburgh and Leith Corporations' Gas Commissioners have just completed an experimental installation. They have put down high-pressure plant at their Calton Hill workshops, and fitted up a number of high-pressure lamps in thoroughfares in the neighbourhood. The compressors, which are in duplicate, are each capable of passing 2000 cubic feet of gas per hour, and compress the gas to 80 inches water pressure. They were supplied and fitted up by Messrs. James Milne and Son and the Welsbach Light Company, Limited.

CENTRAL SUSPENSION LIGHTING IN LITTLE KING STREET, EDINBURGH, ADJOINING THE THEATRE ROYAL.



The Lighting in Front of the Edinburgh Gas Offices, Waterloo Place.

The Lighting of St. James's Square, Edinburgh.

Sixteen lamps, having an illuminating power varying from 3000 to 1000 candles, have been erected at Waterloo Place (in front of the Gas Commissioners' offices), Calton Hill, East Register Street, St. James's Square, and Little King Street. The lamps were supplied by various firms, including Messrs. James Milne and Son, James Keith and Blackman Company, Limited, the Welsbach Light Company, Limited, and the British Graetzin Light, Limited. About 36 ordinary public lamps on the low-pressure system, with a total illuminating power of something like 2500 candles, have been replaced by the new installation, which has a total light-giving power of 25,500 candles.

The lighting and extinguishing will be carried out automatically

from the central station at Calton Hill; and several of the lamps have been provided with two burners, so that one can be extinguished at midnight by means of a wave of increased pressure applied at the compressors. All the lamps, with the exception of one which is hung from an overhead wire on the cross-street suspension principle, are fixed on columns or brackets; and three of these are provided with raising and lowering gear, so that when trimming, re-mantling, or any other adjustment is necessary, the lamps can be lowered to the street level, and attended to.

As the high-pressure mains are laid through the important business thoroughfare of Leith Street, it is intended to supply shopkeepers on the route. The pipes will be extended as applications justify this. It is also hoped that connections for industrial purposes will be required. Already the installation has evoked much favourable comment, not only by the large gathering of Commissioners and others who were present at the inauguration last Wednesday night, but by many possible users of the new method of illumination.

LOW-TEMPERATURE CARBONIZATION IN VACUO.

Discussion on Mr. F. D. Marshall's Manchester University Lecture.

In the last number of the "JOURNAL" (p. 50), we gave the lecture on the subject of low-temperature carbonization delivered by Mr. F. D. MARSHALL before the Manchester and District Junior Gas Association at the Manchester University on the 4th inst. The following is a report of the discussion to which it gave rise.

Principal GRAHAM, who occupied the chair, in opening the discussion, said he was sure the members would agree that they had listened to an extremely able and valuable address from an engineer who spoke from practical knowledge and with the enthusiasm which was born of conviction. It was a marvellous thing to hear an expert tell them that a ton of coal, costing about 15s., could, by low-temperature carbonization treatment for the recovery of the residuals, be turned into products worth more than £4. He agreed with Mr. Marshall that in many places in this country coal was being wrongly treated; and if the present stupendous waste was allowed to continue, he was afraid that one of the nation's fast-vanishing assets would soon disappear altogether. He hoped that when the solid fuel came to be placed on the market, it would be sold at much less than 30s. a ton. From a commercial point of view, it was, of course, advisable to get all they could for the fuel; but in his opinion there would never be a popular demand for it unless it was sold at 20s. or 21s. per ton.

Mr. W. L. HEALD (Preston), the President of the Association, observed that Mr. Marshall's lecture had not only startled some of them, but had put fear into many of their hearts. ["Hear, hear" and laughter.] He was afraid there would be little of the discussive element, because the subject was one which was so far removed from their immediate thoughts. However, as they went carefully through the lecture and the figures in it, they could hardly help feeling that there was a great deal in the process so lucidly described. There was no doubt whatever that a smokeless fuel was required in this country, not only by the class of folk, whom they, as engineers, considered "faddists," but by firms having gas-engines using suction gas. It was certainly true that they, as engineers, produced coke; but coke in its crude state was unsuitable for gas-engine work. He had, however, recently heard of coke coming from Sheffield or Manchester districts which was being treated by a special process with a view to its being used for the work he had indicated. Mr. Marshall had told them that he had a coke which, if not directly used in suction plant, might be employed in pressure plants such as the Mond or the Dowson type. But he (the President) did not gather that the coke was suitable for gas-engine work. Alluding to the shape and size of the coke from the annular or concentric form of retort, the speaker said he supposed the peculiar shape was due to its construction. He would also like to know whether the retorts "warped," and whether they were made of cast iron. The lecturer had referred to the recovery of motor spirit by the low-temperature process. He (the President), for one, was delighted to see these results; and all who possessed automobiles or cycles would view the figures with great satisfaction. There was no doubt that the amount of petrol in this country was insufficient to be sold at a reasonable price; and it was continually on the rise. A competing spirit was urgently wanted. Mr. Marshall had told them that in driving his car uphill he got more than 24 miles per gallon, with no "knock" on the engine. He (the President) often wondered why with one spirit he got a "knock" and with others he did not. The lecturer's remarks had proved extremely interesting, and gave them plenty of intellectual food to be going on with. In the flush of the moment, after listening to Mr. Marshall's eloquence and his wonderful story of the possibility of electricity being sold at ½d. per unit, it almost made him (the President) think he ought to have been an electrical engineer, and not an advocate of gas. Candidly, he had hardly grasped the fact that there was such a tremendous profit to be made by low-temperature carbonization.

Mr. MARSHALL dealt with one or two of the points raised by Mr. Heald. As to the question whether the annular retort installation at Battersea was at all "warped," the reply was in the negative. In fact, he might say that when it was examined at the end of two years it was quite clear, and exactly what they expected it to be at the close of that period. It answered all requirements of the engineers, and he might be pardoned for stating that the system was now well out of the experimental stage. He cordially invited any of them, when visiting London at any time, to come and work the retorts for themselves—in their own way and in their own manner. He wanted to convince them that the subject was not in the theoretical stage. The results he had alluded to had not been obtained for days, but for years. They were contemplating the erection of large works in London, and he hoped that in time they would have at least three plants in the Manchester district—two dealing with cannel and one with slack. The President had also asked whether the retorts were of cast iron. The reply was in the affirmative; and they were an inch thick. Alluding to the use of benzol for motor spirit, he had that morning received a letter giving the approximate results of tests carried out the previous Wednesday on the Portsmouth road. They were even better than the 24 miles per gallon to which he had referred:

Shell No. 1 . . .	sp. gr. ·724 = 23·62	miles per gallon
Benzol	,, ·878 = 25·83	,, ,,
Tarless spirit . .	,, ·794 = 23·87	,, ,,

Mr. Marshall added that the spirit used was distilled at 160° C., and that the engine was started cold.

A MEMBER asked whether the lecturer was not in error in stating that the present-day price of carbon was £42 per ton. Should it not be 42s.?

Mr. MARSHALL: No; £42 is correct.

The MEMBER: But the present market price of gas-retort carbon is about 42s. That was why your figure appeared to me as rather remarkable.

Mr. MARSHALL was understood to say that his figure (£42) represented the price of carbon made under low-temperature conditions. He was not speaking of ordinary retort carbon.

Mr. D. V. HOLLINGWORTH (Birchenwood), the Vice-President of the Association, congratulated Mr. Marshall upon his able lecture. He did, not, however, anticipate for a moment that anything said that day would have the effect of jeopardizing the position of gas companies. He was connected with a company at whose works were carried on coke-making and bye-product recovery operations; and he could therefore well appreciate the remarks of the lecturer and follow his conclusions. The question of ammonia had been mentioned, To some of them there did not seem to be any difficulty about producing ammonia. It could be made by most gas engineers or coke-oven engineers, except that it would jeopardize the production of some other constituent. When the lecturer said it was only a matter of temperature, he did not agree with him. He thought the whole question was largely one of the varying moistures in the coal. He was, however, absolutely in agreement with the lecturer when he said there was a very urgent need for a solid fuel. Not only was the time ripe for its introduction, but it was more than ripe for liquid fuel. Motor users would take up the latter with extraordinary avidity. The development of solid and liquid fuels would not only be the means of fostering all-British commodities, but would make us independent of supplies from abroad—at any rate in regard to liquid fuel and many other matters. In addition to the demand for solid fuel and light liquid fuel, there was, perhaps, a greater demand for creosote oil. There could be nothing but success if the principles enunciated by Mr. Marshall were workable. Summed up, they were based on the necessity for (1) a solid fuel, (2) a light liquid fuel, and (3) creosote oil.

Mr. MARSHALL, alluding to a remark on the demand for solid fuel, said that 1400 people up and down the country were continually sending him inquiries as to "when delivery would be made of the smokeless fuel ordered at the Smoke Abatement Exhibition about a couple of years ago." [Laughter.] This fact showed that at any rate 1400 people were anxiously awaiting it; and he, personally, had no doubt that some day their orders would be fulfilled. Alluding to the demand for creosote oil and light liquid fuel, he said he believed that if a hundred low-temperature carbonization plants were erected, they would about meet the needs of the nation.

Mr. HOLLINGWORTH pointed out that if a very large quantity were placed upon the market at one time, the cost of petrol would doubtless come down enormously to fight the new spirit. The whole matter was one of economics.

Mr. MARSHALL replied that, in his opinion, there was no reason to view with apprehension the question of over-production. Some people said that the "oil age" was coming. This country imported a very large quantity of oil. But why should we let people take so much money out of the country? Let them, as engineers, see whether, by energy, capital, and brains, they could not themselves produce the very article wanted. He saw no danger from over-production.

Mr. S. CARTER (Garston) said it seemed to him that the fuel must be "sulphury," or the sulphur might possibly get away in the gas. If there was sulphur in the gas, it would be a somewhat expensive matter to remove it. It would also be interesting to know if it volatilized quickly when it remained in the fuel.

Mr. MARSHALL said that in the low-temperature process they did not get any more sulphur in the gas than they did at a gas-works. Of course, when manufacturing it they knew that their gas would never be used for domestic purposes. In their process it was absolutely essential to have a thin layer of coal in the retort, because it was necessary to get off all the products in three-and-a-half hours, or at the outside four. When they went over

the four hours, they were getting back to the old state of things. He strongly counselled members to read the account of the investigation of the process by Professor Parr and Mr. Olin, published in the "JOURNAL OF GAS LIGHTING." [See Vol. CXXII., pp. 533, 595.] In this report, the correct method to follow in order to ensure perfect carbonization was clearly set out. Mr. Marshall added that he hoped shortly to contribute something to a similar gathering of the profession, when he had satisfactorily established the effect of oxygen on the evolution of the oils. Addressing Principal Graham, Mr. Marshall went on to say, with regard to the question of smokeless fuel, that he did not believe they had reached finality; but if the gas profession worked together in this and other matters, he firmly believed they would accomplish great things for the benefit of the country. "It will pay you," he added, "and pay you handsomely."

Professor HAROLD B. DIXON said he was sure the members had listened with a great deal of interest to Mr. Marshall's lecture; but whether they had taken it all in was quite another matter. He confessed that he was very much startled by some of the figures which had been given. He thought he might, on behalf of the engineers of the Manchester district, venture to accept with the greatest pleasure the invitation which had been so kindly extended to them to visit the works at Battersea. There was not the slightest doubt that such a visit would prove highly instructive to many of them.

Mr. MARSHALL assured Professor Dixon that he would be delighted to welcome any engineers who were interested in the plant. Every possible assistance would be accorded and information given them.

Professor DIXON also thanked Mr. Marshall for the opportunity he had afforded the members of taking away the samples of the slabs of coke which fell from the annular retort. Personally, he should like to test it, and would now take the opportunity of doing so. The Lecturer had not, he thought, told them what was its gaseous constituent. Was it methane?

Mr. MARSHALL replied that he was not sure. That was the very thing he wanted someone to tell him. He, himself, confessed that he was puzzled on the point.

Professor DIXON added that he thought their hearty thanks were due to Mr. Marshall for bringing before them the subject of his lecture. There was no doubt that a good spirit was wanted; in fact, we wanted all the spirit and oil we could get. The demand for a smokeless fuel for domestic purposes was also a real one, and, from the purely domestic point of view, it was the most important matter of all.

The PRESIDENT moved that the heartiest thanks of the Association be accorded to the Lecturer. They had, he said, listened with profound interest to all he had told them, and deeply appreciated his kindness.

Mr. CARTER, in seconding the motion, said one point which struck him was that, if many gas authorities decided to make gas under low-temperature conditions, and only produced 5000 cubic feet per ton, instead of 12,000 cubic feet as at present, and the demand for the commodity went up owing to its cheapening, it would require some very remarkable revolution on the works for plant to be installed sufficient to treat the enormous bulk of coal that would have to be dealt with; because a large quantity of fuel which at present was being used as coal would be employed as smokeless fuel. This was one of the points they would probably have to think about as they considered the matter more deeply. The whole question was of the greatest possible interest to the gas profession generally.

Mr. J. BRIDGE (Stretford) proposed that the best thanks of the meeting be accorded to Principal Graham for his kindness in taking the chair. Principal Graham, as they all knew, was very much interested in the question of smokeless fuel and in smoke abatement.

Mr. HOLLINGWORTH seconded the motion, which was heartily carried.

Principal GRAHAM said it had afforded him great pleasure to be present, and to find so many sensible people who were willing to spend their time, and use their brains, upon a cause which he believed to be one of paramount importance for the removal of a deep-seated evil in our social life.

The proceedings then terminated.

The Catskill Water Supply of New York.—We have received from Messrs. Chapman and Hall, Limited, of Henrietta Street, W.C., a volume entitled "The Catskill Water Supply of New York City: Its History, Location, Sub-Surface Investigations, and Construction," by Mr. Lazarus White, Associate Member of the American Society of Civil Engineers, Division Engineer of the Board of Water Supply. The author begins appropriately with a history of the New York Water-Works from 1613, next explains the constitution of the Water Board, and then proceeds to describe in detail the engineering features of the great work named in his title. He was encouraged to undertake the production of the book in order that a contemporaneous record of the gigantic construction for the Catskill water supply should be made and published; and he was able to do this with the liberal assistance of Messrs. John Wiley and Sons, the well-known firm of New York publishers. The results of their combined labours will be more fully noticed in a subsequent issue of the "JOURNAL." Meanwhile it may be mentioned that the price of the book is 25s. 6d. net.

PETROL AND BENZOL AS MOTOR FUELS.

At the Opening Meeting of the Winter Session of the Association of Automobile Engineers last Wednesday, the PRESIDENT (Mr. J. S. Critchley), in the course of his Inaugural Address, referred to almost every phase of the fuel question. The following are the portions of special interest to "JOURNAL" readers.

THE PRESENT POSITION.

The demand for motor fuel derived from petroleum, apart from the petrol required for automobiles, is increasing at a very rapid rate, with a corresponding increase in price; and the automobile engineer must seriously consider what are the future prospects of obtaining a fuel suitable for the internal-combustion motor at a price which will not impede the development of the industry. The cost of petrol has steadily risen, till it now commands a price which, without doubt, seriously handicaps the development of the commercial vehicle. The automobile motor is a type of engine in which economy has of necessity been sacrificed in the desire for small size and weight. For example, the indicated thermal efficiency of a first-class motor engine is approximately 28 per cent., while the brake thermal efficiency is about 22 per cent., whereas in tests of gas-engines a brake efficiency of 26·7 per cent. is obtained with an engine of 5 H.P., 28·3 per cent. with a 30-H.P. engine, and 30 per cent. with a 60-H.P. engine.

Petrol is to-day about the most expensive fuel that can be employed commercially for power production. Taking its cost at 1s. 8d. per gallon, approximately 7000 B.Th.U. will be obtained for 1d.; and, allowing for the loss in motor efficiency and the transmission losses, only about 1500 B.Th.U. for 1d. will remain; while crude oil at 3½d. per gallon would give some 40,000 B.Th.U. for 1d., coal at 18s. per ton would give about 62,000 B.Th.U., and coal gas at 2s. 6d. per 1000 cubic feet some 23,000 B.Th.U. With petrol at its present prevailing price, it is obvious that the automobile cannot be compared in economy with other types of motors in which a cheaper fuel is employed. In view of the enormous increase in the demand for petroleum spirit and petroleum products generally, and the consequent rise in ocean freights, there does not appear to be any prospect of a reduction in the price of fuel unless a new source of supply can be obtained.

UTILIZATION OF BENZOL.

The employment of benzol is a question which has come to the front very much during the past year. While the supplies of this fuel are somewhat limited at the present time, we have the authority of the Editor of the "Commercial Motor" for the statement "that by the end of 1915 some 70 million gallons of this fuel will be produced per annum, and without reckoning in the potential yield which may be turned into account at any time of emergency by stripping town gas of its benzol."

A production of this magnitude alone would undoubtedly tend to prevent any further rise in the price of petrol; and there is evidence that it is being increased yearly, so that it will probably mean a reduction in the price of fuel generally. In 1906, the supply was stated to be 4 to 5 million gallons per annum, one-third of which was exported. In the evidence given before the Royal Automobile Club Petrol Committee the amount now available was given by one witness at 10 million gallons, by another at 23,460,000 gallons of crude spirit, yielding 25 per cent. less spirit when distilled for motor use.

In Germany, the approximate production in 1909 was 16 million gallons, increasing to 28 millions in 1912. The amount of benzol produced by gas-works does not probably exceed 1½ million gallons per annum. It is the object of the gas maker to retain as much benzol as possible, in order to enrich the illuminating quality of the gas. By the use of vertical retorts, the output of tar and benzol is increased without reducing the gas output; and in course of time the vertical retorts may supersede the horizontal ones. But even a complete change would not more than double the output of gas-works benzol. The coke-ovens are a more prolific source of benzol. With recovery coke-ovens the supply is about 10 million gallons; and assuming that all the coke was produced by bye-product recovery ovens, there would be a yield of about 30 million gallons from this source. The present price of benzol is about 1s. 4d. per gallon retail, and about 1s. in casks at the makers. This is a much higher price than that which prevailed some years ago, when benzol was sold as low as 5d. to 6d. per gallon. If there is any certainty of the present price of fuel being maintained, it will no doubt encourage the further installation of recovery plants.

LOW-TEMPERATURE DISTILLATION.

With low-temperature distillation, the temperature is only about 450° C., against 1250° C. in the high-temperature processes employed in gas-works and recovery plants. Further, the tar with low-temperature distillation is susceptible to "cracking" (being paraffinoid in character), by which a further yield can be obtained; and the fuel has, therefore, more of the qualities of petrol than benzol produced by high-temperature distillation. A process which has recently been developed is known as the "tarless fuel" process, the principle of which is the carbonization of coal with low temperature and high vacuum. Under this system, from 4 to 10 gallons of motor spirit per ton of coal is claimed, together with

a fair yield of fuel suitable for Diesel motors and fuel from bituminous coal with a good physical texture free from tar.

Production and Price of Benzol.

Many projects have recently been put forward having for their object the more general utilization of coke, and, therefore, the increased production of tar and fuel oils and benzol. It is estimated, for example, that if coke were burnt in houses instead of coal, there would be an ample supply of fuel for the automobile trade, besides heavy oil for Diesel engines and steam-boilers. These schemes, however, are mere visions. Pure benzol freezes at 42° Fahr., and to keep it fluid in cold weather a mixture with toluol (C_7H_8) is necessary. To produce 100,000 gallons of benzol and toluol, coal to the amount of 1,625,000 tons is treated; and 100,000 gallons produced per annum would only be sufficient for two days' fuel supply for the London General Omnibus Company. The cost price of benzol at the gas-works is stated to be 8d. per gallon in bulk. At 8d. per gallon there is no profit over selling the tar at 3d. per gallon. The heat value of benzol is, according to Thomsen, 18,188 B.Th.U., though some authorities give it at 20,000 B.Th.U. However, as benzol has a higher specific gravity, the heat units per gallon are for benzol 158,000, and for petrol about 140,000. It is therefore evident that, measure for measure, benzol might be expected to give greater power than petrol. In actual practice, it has been proved to give an increase in mileage of about 20 per cent., and from 12 to 15 per cent. more power.

Higher Compression Needed for Benzol.

The carburation of benzol presents no difficulties. But it is doubtful if the best results are obtained with an engine which has been designed for petrol; and it is probable that if a type of engine were specially designed for benzol, greater efficiency would be obtained than by merely employing the fuel with an engine designed for petrol. Benzol, by reason of its high carbon and low hydrogen content, should, like alcohol, be capable of standing a higher compression than petrol. Dr. Karl Buchner maintains that benzol should be treated similarly to alcohol, and contends that the carburettor should merely be the atomizing and mixing device, and that the cylinders should be so designed that, during the suction stroke, heat should be transmitted to the mixture. The best temperature for the walls should be determined by experiment. Long-stroke motors are advocated to assist in the vaporization, and a compression ratio of 9 to 10. Dr. Buchner points out that the fact that existing petrol motors permit of the use of benzol has made it appear as if the question of using benzol were merely a carburettor problem, and has engendered a certain indifference to a more complete and rational development of the true benzol motor.

By tests conducted by Professor Riedler, it has been demonstrated that more heat units are required for developing 1 H.P. from benzol than from petrol with the ordinary petrol engine; while with stationary motors specially designed for benzol, with high compression, the consumption of heat units is considerably less. Therefore the waste is one attributable to design and not to any inferiority of the fuel. A high compression, as with alcohol, tends to make a motor less sensitive to variations of proportions of the fuel mixture. Dr. Buchner suggests the development of a motor with a compression of 140 lbs., with a possible additional equipment for the forcible injection of surplus air to facilitate the atomizing and combustion of a high fuel charge. Motors of this class could be operated by benzol or other fuel derived from coal distillation, including naphthalene.

Possibilities of Alcohol.

After discussing the possibility of obtaining liquid fuels from bituminous coal and shale, the President turned to a consideration of alcohol, which has been advocated by many experts as the ultimate solution of the fuel problem. On this subject he said: Before alcohol could be used for motors the excise restrictions would have to be modified, and also the regulations in regard to the nature of the fluids added to render the liquid undrinkable. Alcohol differs from the hydrocarbons used as fuel, inasmuch as it contains oxygen; its constituents being carbon 52·2 per cent., hydrogen 13 per cent., and oxygen 34·8 per cent. It contains about 12,600 B.Th.U. per pound; but as it holds from 10 to 20 per cent. of water, it cannot be calculated at more than about 10,000 B.Th.U. per pound. As petrol contains 19,000 B.Th.U., the comparison is not in favour of alcohol. In addition to having 10 per cent. of water to deal with, the heat required for the evaporation of alcohol is considerably greater than that needed for petrol. Put into figures, 2½ times greater heat is required for the evaporation of pure alcohol; and then the 10 per cent. of water requires about 5½ times the amount as compared with petrol. Before the question of the suitability or otherwise of alcohol as a fuel for automobiles can be fully decided, a very great amount of research work will be necessary. In the first place, there is the question of the production of alcohol in sufficient quantities at a price which will make its use economical. If the motorists in this country are serious in endeavouring to provide a fuel which can be produced in unlimited quantities, and not subject to market fluctuations, they should get together and devise some means whereby sufficient money can be provided to decide the question as to the possibilities of alcohol. This and the more economical utilization of our coal wealth are matters of the very utmost importance—in fact, they are national matters. In coal we have all that we require for motor fuel, both heavy and light. I should therefore like to see the whole question of fuel supply taken in hand by a body of experts with a large sum of money to carry out research work, so as to decide on matters which are in doubt, and which can only be proved by trials and experiments of a costly nature. I am of opinion that the British Empire could within itself produce all the fuel it requires.

GAS ACCOUNTS AND FINANCE.

At the Annual Meeting of the Institute of Chartered Accountants at Leeds last Thursday, Mr. William Cash, F.C.A., read a paper on "Gas Accounts and Finance, with a Sketch of the History of the Gas Industry." The following are the portions of the paper dealing especially with finance.

Having given a sketch of the early history of the gas industry, the author indicated the inventions and improvements which have been introduced. He pointed out that one most important feature in the growth of the industry has been the steady reduction in the price of gas. It was now generally recognized that reduction in price meant increase of business; and in spite of the keen competition of the electric light, gas not only held its own in the volume of business transacted, but showed year by year advancing records of quantity consumed. He gave the following figures regarding statutory gas companies, showing how the industry has advanced:

Year Ending Dec. 31.	No. of Companies.	Share and Loan Capital Paid Up.	Gas Sold. Cubic Feet. Thousands.	No. of Consumers.
1882	352	£32,934,935	45,484,910	1,055,009
1891	422	41,144,281½	65,338,277	1,180,333
1901	454	74,977,378	89,685,208	2,048,359
1911	520	92,989,680	119,497,425	3,906,528

The corresponding statistics for local authorities undertaking supplies were:

Year Ending March 31.	No. of Authorities.	Loan Capital Paid Up.	Gas Sold. Cubic Feet. Thousands.	No. of Consumers.
1882	148	£17,326,183	21,129,034	916,962
1892	182	22,476,180	34,531,527	1,172,704
1902	251	34,045,442	54,373,348	1,872,633
1912	302	43,108,248	75,053,780	2,743,376

In the last year under review, the total consumption of coal by the companies and the local authorities reached a total of 15,635,012 tons. As showing the extraordinary growth in the number of the penny-in-the-slot consumers during the last ten years, Mr. Cash set out the following information—selecting one Metropolitan, one Suburban, and two Provincial gas companies, together with the records of three corporations:

	1902.	1904.	1909.	1912.
Gaslight and Coke Co.	136,507	188,747	330,621	460,064
West Ham Company.	—	10,716	48,154	
Croydon Company	8,029	10,531	17,721	21,014
Bristol Company	6,955	10,914	21,997	27,552
Newcastle Company	13,288	27,083	59,467	66,756
Birmingham Corporation	23,862	36,376	69,056	82,138
Leeds Corporation	—	—	45,227	50,302
Manchester Corporation	38,495	44,341	58,041	66,153

In all the cases quoted, except Bristol and Manchester, the total number of prepayment consumers now exceeds the number of ordinary customers. The three Metropolitan companies together have more than 800,000 consumers supplied by this method. As an example of the continually increasing use of gas-stoves, the author mentioned that the Croydon Company, with 42,437 consumers, have 35,665 stoves and fires on hire, in addition to the very large number but privately owned; while the Gaslight and Coke Company own about 500,000 of these appliances.

Dealing with the supply of gas by local authorities, Mr. Cash gave the following figures showing the sums which certain of the larger Municipalities contributed in aid of rates from their gas profits in the year ended March 31, 1912.

		Net Price Realized for Gas.
Birmingham	£80,681	1s. 9·2d.
Bolton	20,000	2s. 5·4d.
Leeds	22,222	2s. 1·0d.
Leicester	34,368	2s. 3·8d.
Manchester	50,000	2s. 3·1d.

He pointed out that all these Corporations provide meters free; and he said the figures quoted showed that these Corporations, with many others, afford substantial benefits from gas to their ratepayers, after providing for interest and sinking fund on the capital employed.

The author next offered a few remarks on foreign gas companies inaugurated with British energy and enterprise; and then he referred to the relationship of Leeds with the gas industry; specially mentioning the creation of the professorship in Coal Gas and Fuel Industries, with Metallurgy, at the University.

Turning to the question of finance, Mr. Cash said he should deal more particularly with the guiding or main principles. He first mentioned the passing in 1845 of the Companies Clauses Consolidation Act, which, with certain exceptions and modifications, is incorporated in the Special Act of every gas company, and to the subsequent passing of the Gas-Works Clauses Acts of 1847 and 1871. He said that for his present purpose he need

only refer to the last-named Act, by section 35 of which the form of accounts as set out in a schedule to the Act was imposed on gas companies. Accounts in this form had to be sent each year to the local authority of every district within the limits of supply; this provision being supplemental to the provisions (section 38) of the Act of 1847, which makes it necessary for the annual accounts to be sent to the Clerk of the Peace for the county for filing, such filed copy being available for inspection by the public. He then explained that under the provisions of the Act of 1847, the profit to be divided among the shareholders is limited to 10 per cent. on the paid-up capital, with power to make up any deficiency of dividend out of future profits, and with the obligation to accumulate as a reserve fund any surplus profits to an amount not exceeding one-tenth of the nominal capital. This reserve fund is available to meet any extraordinary claim or demand, and to make up any deficiency in the prescribed dividend. Dividends on additional capital have always been less than the 10 per cent. allowed on the original capital; the usual provision being 7 per cent., or, if preferential, not exceeding 6 per cent. After the reserve fund is full, the undertakers must apply any surplus profits in the reduction of the price of gas. There are provisions for compelling such a reduction by legal proceedings, but these proceedings are cumbrous and difficult, and cases have been very rare, owing to the faulty manner in which these particular provisions are framed. Powers for loan capital or borrowings on mortgage have been given for many years to the extent of one-fourth, or in later cases one-third, of the paid-up capital. Combined with a maximum dividend to the shareholder, each Special Act contains a maximum price to be charged for the gas supplied.

The author next referred to the introduction of the sliding-scale in 1875, and two years later of the auction clauses, and said the latter had had a remarkable effect. In the eight years, 1899 to 1908, about £8,000,000 of capital was raised by various statutory gas companies, and premiums were received of approximately £1,450,000. The consequent cost of the capital in the shape of interest or dividend had been kept as low as possible, and the consumer had reaped the benefit in the reduced price of gas. The fixing of the standard price was dealt with; the author explaining that the general basis had been 5s. per cent. on 10 per cent. capital for every penny in the price of gas. On converted capital of 5 per cent., the dividend variation had been 2s. 6d., and in some cases 3s. 6d., per cent. when applied to 7 per cent. additional capital.

Along with the sliding-scale came an alteration in the reserve fund provisions, which Mr. Cash explained as follows:—

> The old limited reserve was done away with; and in its place came a fund with no limitations, but built-up out of divisible profits only. In other words, the shareholders may out of their share of the profits lay aside "such sum as they think fit." For many years, sliding-scale companies were allowed an insurance fund; the annual contribution being limited to 1 per cent. on the capital, and the total to 5 per cent. on the capital. This was equitable. The new reserve was for deficiency in dividend, the insurance fund for extraordinary claim or demand—the two together fulfilling the same purpose as the old reserve fund under the 1847 Act.
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> But certain companies asked for something further, and that in the form of a renewals fund, which, between 1900 and 1908, was granted to most of the companies then in Parliament. Gas companies, like railway and other companies of a continuous and permanent nature, created under statutory authority, do not provide in advance for depreciation of plant or machinery. But cases had occurred where the want of such a fund had been felt; and these particularly arose where works had to be abandoned, or rebuilt on the substitution of more modern plant, or the inability to expand on an existing inadequate site necessitated the removal of the works as a whole. But it was felt that too many funds might tend to pile up profits unnecessarily, and so delay the desired end—the reduction in the price of gas. After 1908, therefore, the insurance and renewals funds were amalgamated into one fund, under another title—the special purposes fund. The contribution is 1 per cent. per annum, and the limit is 10 per cent. on the paid-up capital, including premiums.

The Model Bill provides that the special purposes fund "shall be applicable only to meet such charges as a chartered accountant or incorporated accountant being the auditor of the company, or appointed for the purpose by the Board of Trade, shall approve as being (*a*) expenses incurred by reason of accidents, strikes, &c. . . . or (*b*) expenses incurred in the replacement or removal of plant or works other than expenses requisite for maintenance and renewal of plant and works." Mr. Cash said an attempt had been made in the past session to alter this clause so as to extend the appointment of the accountant to include membership of bodies other than the Institute or the Incorporated Society. He could not say if this had been successful; but though the matter to be dealt with by the accountant was not a large one, the underlying principle, that he should be a fully qualified and competent person was of great importance; and in his opinion, the clause formed, as it stood, a precedent of real value.

After a few remarks on the clause in the Model Bill limiting the "carry-forward" to "the amount required to pay one year's dividend at the authorized rate on the issued capital," Mr. Cash dealt with the conversion of loan capital, and then summed up the financial provisions of a gas company's Act by explaining the system by which the consumer has become a partner—sharing surplus profits, and bearing his proportion of additional cost due to adverse circumstances, such as a rise in the price of coal or wages—the shareholder being allowed to accumulate reasonable reserves for the protection of his dividends or interest. On the question of proportion, he said it was interesting to note that, as a consequence of the growth of business, the terms on which capital has been raised, and the wise endeavours which have prevailed in the main throughout the industry to keep down capital and capital charges, the consumer has received the bulk of any available surplus, due to improvements, modernized methods, or economies. It would not be unfair to say that in a typical case this might to-day be taken at five-sixths to the consumer, and one-sixth to the shareholder.

From the partnership of the consumer, Mr. Cash next passed on to deal with that of the employees; and he stated that on the 31st of December last more than thirty companies, with a capital of £51,000,000, had co-partnership and profit-sharing schemes in operation, affecting 23,000 employees. A sum of £124,000 was appropriated as profit, and about £750,000 was then held by employees invested in stocks and shares. Only four schemes were more than five-and-a-half years old; so that the results were by no means insignificant on financial grounds alone. The percentage on wages varied from 4 to 8¼ per cent.

Returning to finance and accounts, Mr. Cash explained what has been done in connection with the allowance for depreciation and income-tax. He stated that, after several discussions of a friendly and interesting nature, a scheme was evolved, and when the draft had been approved by a large number of gas companies throughout the kingdom, it was accepted by the Board of Inland Revenue in the form of an agreement available for adoption by any gas company. He thought the Inland Revenue authorities met the companies very fairly; and though, of course, the scheme might be considered as a compromise, the principle of provision for depreciation and allowance was admitted. Briefly, the agreement provided for an allowance for depreciation, based on diminishing values, as follows: On gasholders, including steel or iron, but not brick tanks, 3 per cent.; on meters (both ordinary and prepayment), stoves, and cookers, 10 per cent. The total annual expenditure on street services and house fittings was to be allowed as a revenue charge. With regard to the principal or long-lived plant, and also in respect of mains, no claim was to be made or allowed for depreciation; but renewals as arising were to be charged to revenue, with the added condition that all renewals of meters and stoves should be charged to capital.

"This arrangement," said Mr. Cash, "falls in very simply with existing records and practice of the majority of companies; and a large proportion of undertakings have adopted the scheme." The agreement was given as an appendix to the paper.

Having offered a few remarks on the annual returns which have to be furnished to the Board of Trade, the publication of "Field's Analysis," and the manner in which the Technical Press connected with gas industry is conducted, Mr. Cash said he could not better conclude what was a very imperfect attempt to deal with a limited aspect of the industry than by expressing his humble but very genuine admiration for all those men, in both important and minor positions, who show so much ability and such extreme zeal in the discharge of their duties to the public and the undertakings they serve. "Through them, and their predecessors in office," he said, "the industry is most splendidly organized, with a completeness that is the more surprising the more it is investigated. It is to these men the industry owes its present position, its continuing prosperity, and the fact that it has surmounted opposition and successfully met competition."

Locating Leaks in Water-Mains.

The officials of the Department of Water Supply of New York City are experimenting with a device for locating hidden leaks in water-pipes that utilizes the laws of transmission of water-hammer. Mr. W. W. Brush, the Deputy Chief Engineer of the department, in a paper read at the meeting of the New England Water-Works Association, described the instrument, which is called the "pulsograph," as follows: "It consists essentially of a large sensitive pressure recorder having a rapid motion, a tuning-fork vibrating at the rate of 200 vibrations per second, and a quick-operating valve, which is on a blow-off or bye-pass pipe. The instrument is set up by screwing it to a hydrant nozzle; the hydrant being chosen so that there will be a straight run of several hundred feet before an open four-way branch is encountered. By closing the valves on intermediate branches, the effect of a long isolated line can be obtained. In operation, the valve on the main below the hydrant is closed, and water is allowed to flow from the hydrant through the bye-pass. By quickly closing the valve, a water-hammer of about 15 lbs. is created and recorded on the pressure-gauge. This pressure is maintained until water-hammer pressure reaches the open branch at the end of the pipe-line that is being tested, and the drop in pressure has travelled back to the hydrant; the tuning-fork vibrations showing the time for this double travel. By dividing twice the distance along the main to the open branch by the time, the rate of travel for the particular pipe is determined. This has been found to be approximately 3600 feet per second for 6-inch pipe, and about 4200 feet for 12-inch. If there is a leak in the main or in a service near the main, the water-hammer pressure is materially reduced by the leak, and the chart then shows separately the reduction due both to the leak and to the open branch. Several leaks have been located by this instrument within limits of less than 20 feet."

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

PRESIDENTIAL ADDRESS

OF

MR. THOMAS GOULDEN, Assoc.M.Inst.C.E.

Gentlemen,—Allow me to preface the few remarks I have to make to you to-day by first assuring you of the deep sense I entertain of the honour you have done me in my election to the office of President of this Association, and to ask you to accept the assurance that during my term of office my best endeavours will be given to emulate the example of those gentlemen who have preceded me in promoting the interests of the Association over which they have presided.

TWENTY-FIVE YEARS' WORK OF THE ASSOCIATION.

There are especial points of interest in this meeting. The first, personal to ourselves—being that it is the fiftieth half-yearly meeting that we have held. This a goodly record of time; and it is surely permissible on this occasion that we, the present members of our Association, should congratulate ourselves that it should have reached the position of this landmark in its history through a period of continued usefulness such as our records are able to show. It is fitting that we should make grateful acknowledgment of the debt we owe to those who have given of their best in the promotion of its interests through the days that are gone. We have a profound belief in the vitality of our Association, and in its continued capacity for promoting the personal intercourse and that free exchange of professional ideas and experiences which are productive of so much that is good in promoting the progress of our industry—the common aim of its members. There is also the added interest of holding our meeting in the midst of the National Gas Congress and Exhibition, which is being held during the fiftieth anniversary of the foundation of the Association that is now represented by the Institution of Gas Engineers.

THE GAS EXHIBITION.

It is difficult to express oneself adequately with regard to the magnificent success achieved by the Executive Committee as the result of their labours. The hand of an organized industry is everywhere recognizable; and the artistic skill with which it has been directed in this unique demonstration of the versatility of gas in its many methods of application for the use of the community is no less remarkable. I am glad of the opportunity of offering, on behalf of the Eastern Counties Gas Managers' Association, our heartiest congratulations to the Executive Committee, whose exertions have culminated in so striking an exposition of the many uses for the service of the public in which the staple commodity we manufacture, gas, may be beneficially employed. Especially would we congratulate the esteemed President of the National Gas Congress and Exhibition, Sir Corbet Woodall, the Governor of the great Company to which I have the honour to belong, on having, in his capacity as President, added yet another to the many wreaths of laurels he has earned in this year of Jubilee. May he be long spared to us to continue his energetic and useful career as the acknowledged leader of our industry.

I would add that we join as an Association in expressing our acknowledgment of the painstaking work of the Chairman of the Executive Committee, Mr. F. W. Goodenough, whose skilful and untiring efforts have been largely instrumental in the attainment of the success which has been achieved.

The excellence of gas as a means of public lighting may be seen in practically any district in which it is used, so long as an efficient maintenance service is employed. In the principal streets of Westminster, for example—and I only instance this city as I am better acquainted with it than any other—while the low-pressure lighting is admirable, the high-pressure lighting now adopted is not to be surpassed. For private lighting gas is both economical and hygienic; while the beauty of modern design in gas-fittings makes its application satisfying to the most artistic eye. It is needless to point to its many uses in the household for heating and cooking purposes. The activity of our stove departments shows the extent to which gas is appreciated for this service.

The variety of industrial purposes for which gas is now used is well indicated by the contents of this exhibition; and I believe that no more complete exemplification could be afforded of the progress made of recent years in the applied uses of gas, whether for public or private lighting, and for domestic or industrial purposes, than can be seen within the walls of these buildings. Numerous as are the exhibits, and varied as they are in character, however, they are, after all, only a page or two of the book which, far from being a complete catalogue, would be more lengthy than I could well enumerate here, or you would care to listen to. They are convincing evidence of the rapid broadening of the base on which our business rests, and, alone regarded as such, are of especial interest to us, representing as they do a sufficient guarantee of the future stability of our industry.

The essential feature of this exhibition—and one that must add not only to its attractiveness and to the maintenance of interest throughout its entirety, but that also contributes greatly to its educational capacity—is that the exhibits shown consist of a great variety of object-lessons in the use of gas, each exemplifying a separate purpose for which it may be advantageously utilized. In former exhibitions which I have visited, a conspicuous feature has been the wearisome repetition of exhibits of large numbers of appliances in groups, differing only slightly in some detail of design or construction, but all intended for the accomplishment of an identical purpose. The scope of this exhibition, by the limitation of the space required for a particular class of exhibit, has thus been largely extended; the result being a far more complete gas exhibition than could have been possible under any but the excellent system of arrangement that has here been adopted.

I have not made any reference to the gas congresses or the popular lectures, which will not be by any means the least important sections of this month's demonstration of the part the use of gas plays in modern life. The merest glimpse at the syllabus of lectures to be given, and the papers to be read, however, sufficiently indicates the interesting nature of the subjects chosen; while the names of the lecturers, and those of the authors of the papers, are in themselves a guarantee of the quality of the information to be gleaned. In so brilliant an assembly of names, it would be only impertinent to particularize even with regard to one. It is evident, however, that the mental bill of fare offered us is liberal in the extreme, and he will be a glutton indeed whose intellectual appetite is not appeased by the end of the month. My own fear is of acute mental indigestion becoming epidemic among us. It only remains for each one of us to do his best to derive the greatest amount of good to be obtained from both congress and exhibition, and to support the Executive by ensuring the greatest possible attendance of our respective consumers.

COMMERCIALISM.—WORK OF THE BRITISH COMMERCIAL GAS ASSOCIATION.

This is an age of salesmanship. I believe it was put a little while back as being the age of the "commercial traveller." We want more than the commercial traveller, however. The gas industry has now to fight the most strenuous opposition in order to maintain and increase its business; and that this may be successfully done, the gas sales part of our business must be cultivated no less assiduously than that of manufacture.

The rapid extension of the industrial use of gas, to say nothing of its use for domestic purposes, has rendered the salesman's side of our business so complex in its character, dealing as it does with the many technicalities belonging to the large number of varying trade purposes for which gas is now utilized, that the advisability, if not the necessity, of its administration as a department separate from that of manufacture has become a self-evident proposition. Given fair competition, we have no fear of our resulting success. We ourselves thoroughly recognize the merit of the commodity we have to supply; but the complete education of the public on its merits also is what is desired.

I cannot speak too highly of the work that has been done by the British Commercial Gas Association in this direction. Every gas undertaking in the kingdom must have been benefited by the work that it has done, and it should be supported on an equally wide basis. While much, however, may be accomplished by journalism, there remains the necessity for bringing understanding to the consumer by means of personal agency; and for this the employment of the expert salesman thoroughly equipped with the knowledge of his subject appears to me to be needful.

Times have changed since, apart from the services of simple forms of lighting, gas was only used for cooking, and to a limited extent for heating, and for supplying motive power to gas-engines. Now, while immense advances have been made in methods of employing it for public lighting and in the domestic home, its use for industrial purposes has been so largely developed that it is difficult to believe that any limitation can be set to the extent of its application. Hence the necessity for the expert, who can not only advise the consumer as to the best methods by which his expressed needs may be attained, but who can, out of his own especial knowledge of what may be done with gas, find fresh directions in which new applications may be beneficially employed.

I am, of course, well aware that in a considerable number of cases single undertakings could not, acting alone, support the class of employee I have indicated; but by acting in groups, it is possible that much might be done, both in this and other directions, such as the maintainance of staffs of cookery demonstrators and in the technical education of employees—to name only two instances.

TECHNICAL TRAINING AND EDUCATION.

The evolution of the gas sales department, it is well known, has been steadily taking place through recent years; but in no Company has its importance been more thoroughly recognized than in that in which my sphere of labour lies. The technical training of the employees of the Gaslight and Coke Company in their gas sales and outdoor department has been the subject of considerable solicitude on the part of the management for a considerable time past, and has been much forwarded by means of series of lectures given by thoroughly qualified lecturers, followed by the holding of periodical examinations. The result of this procedure is most encouraging; the general level of the technical information possessed by the employees being not only considerably raised, but their better knowledge of the technique belonging to the consumption of gas, and the appliances by which it is conducted, ensure the exercise of greater intelligence and increasing interest in the carrying out of their respective duties.

A consideration of the work my Company is doing in technical

education would not be complete without reference to the excellent system of training lads as gas-fitters for employment on the outdoor staff. The system followed is that of joint training by the Company and the London County Council. The lads are trained mechanically in the Company's shops and by working with qualified fitters on the district; while they are instructed in the ordinary educational subjects—writing reports, arithmetic, mechanical drawing, &c.—in one of the London County Council technical schools. The boys so trained become expert workmen—much desired by the older employees with whom they serve—and the working of the scheme is altogether an unqualified success.

PROGRESS IN CARBONIZATION.

Turning now from these subjects, it will be of interest to review the relative position of to-day with regard to manufacture, which, after all, is our especial province as engineers, and is, moreover, my own particular concern in the subdivision of responsibilities necessitated by the magnitude of the undertaking in which my professional duties are exercised. It appears to me that in this we may fairly claim a considerable degree of progress during the last decade. Improved methods of carbonization have resulted in a largely increased yield of gas per ton of coal carbonized. The accounts of the three Metropolitan Companies show that during the year 1902 the average make of gas per ton of coal carbonized was equal to 10,277 cubic feet. During 1912, this was increased to an average of 12,373 cubic feet per ton of coal, equal to a 20 per cent. additional quantity. The saving in coal last year in the Metropolis, owing to the increased rate of production I have mentioned, amounted to no less than 657,000 tons—so large a quantity as to be capable of exercising a serious influence on coal prices, and the necessity for which, last year, in the absence of increased production, would have added considerably to the difficulties of a situation sufficiently embarrassing, owing to labour troubles, which were especially to the front in the supply of coal during the spring and early summer last year.

The increased yield of gas to which I have referred was made possible by improvements in carbonization; but these could not have been utilized to anything like their full extent, except for the reduction in the illuminating power of the gas supplied by the Gaslight and Coke and the Commercial Companies, and the use, during the latter portion of the period, of the No. 2 "Metropolitan" argand burner in the statutory testing of gas. For many years previous to the time of the introduction of this burner for official testing, the No. 1 "London" argand burner—the standard burner used in the Metropolis—had considerably diminished the apparent value of the gas under test; and the Companies had therefore been compelled, in effect, to supply a gas of about a candle to a candle and a half excess value, to the considerable prejudice of their working results. It is no small debt that we owe to the gifted Chairman of the South Metropolitan Gas Company for the production of his testing burner, which, when adopted, was the means of our gas being more fairly valued. It is pleasing to note that this improvement in gas production was accompanied by an increase in the amount of ammoniacal liquor made, equal to no less than 27 per cent.; while the production of the tar was only lessened by 2 per cent.

CALORIFIC AND ILLUMINATING VALUE.

Marked as is the improved carbonizing result I have referred to, I am fairly convinced that we are as yet by no means near finality in the production of gas from coal through the agency of destructive distillation. It must appear somewhat strange to the outside observer that, after a century of gas manufacture, we should have the problem of how to most advantageously carbonize our coal still unsolved; but the fact remains, and well it is for the young men of our industry that it is so. There is yet ample scope for the exercise of their energies in this direction. A short time since, a series of experiments, under my direction, as to the possible make of gas from a first-class Durham coal in a retort of normal section, were made in order to ascertain the maximum amount of gas we could produce from a ton of coal in the existing form of horizontal retort. The best result obtained was 15,840 cubic feet—measured, of course, under standard conditions of temperature and pressure. The calorific value of the gas so produced was equal to 530 B.Th.U. gross, or 470 B.Th.U. net, per cubic foot. The illuminating power, measured by the No. 2 standard burner, was 12·15 candles. The composition of the gas showed that it had been fairly obtained from the coal, and owed nothing to infiltration from the exterior of the retort. The analysis was as follows:—

CO_2	1·2
O	0·9
CO	8·0
CH_4	31·3
C_nH_m	2·5
H_2	46·5
N_2	9·6
	100·0

This is an important result, and clearly indicates that, much as the improvement in the rate of gas production has been, there still remains more that may be done. A noticeable feature in the experiments was the gradual increase in the total heat units obtained as the make of gas increased, from 7,300,000 per ton of coal at a make of 12,000 cubic feet, to 8,395,000 at the highest make reached. This is a point of considerable importance in view of the fact that it is in reference to heat units rather than illuminating power that the manufacture of gas will in the not-distant future have to be conducted. The illuminating power of the gas, as was expected, decreased as the make per ton was increased, until, at the highest make of gas recorded, it fell to only a little more than 12 candles.

The particular significance of the results of the experiments to which I have made reference lies in the fact that, in order to most advantageously utilize the possibilities that lay in the coal which was the subject of treatment, a modicum of illuminating power had to be sacrificed in order to realize the maximum number of heat units obtainable. The general result of the experiment, however, was eminently satisfactory, since heat units are now the particular quality which constitutes the practical value of the gas we sell to the consumer. Since the introduction of the incandescent system of gas lighting, the use of town gas for the development of artificial light by means of luminous flames has slowly dwindled, until it is now a negligible quantity, except in a few districts where gas of a high standard of illuminating value is still distributed. The consequence is that there is no longer any logical defence for the continuance of flame value as a factor by which to measure the quality of gas; and the consumers' interests will be more practically protected by the substitution of a calorific standard for that of the illuminating power standard, which, through the alteration in method of utilizing gas for the production of light, has become obsolescent, being no longer comparable with any method by which gas is now utilized by consumers.

Beyond the fact that the calorific test is made under conditions comparable with those attaching to the normal use of gas, it appeals to me as a means whereby to arrive at a determination of the value of gas in terms of definite physical quantity—the heat units it possesses. In this, the calorific method of valuation differs characteristically from that of the valuation of gas by an illuminating power standard; a statement of illuminating power not being that of a physical quantity possessed by the gas, but rather an expression of quality, varying, in its ultimate resolution into quantity, with the burner used for the combustion of the gas, and the conditions under which combustion takes place. There is also absence of the personal factor in the making of the calorific test—its conduct depending upon actual measurements of water and gas, and thermometric observations. It is no new fact that I am stating, but one that has been realized for many years past on the Continent—more particularly in Germany, in the principal cities of which Empire an inquiry as to the illuminating power of the gas distributed at the present day would probably be received with an uplifted eyebrow, and could only be answered after the making of a special experiment for the purpose of enabling a reply to be given. It may be taken for granted that in no country is the interest of their citizens better regarded by the various municipalities than are those of the principal cities of Germany; and the fact that, in so admirably lighted a city as Berlin and its suburbs, the subject of illuminating power is an absolutely negligible factor, should give us "furiously to think" with regard to our own procedure here.

I have dwelt on this point somewhat at length because, until the illuminating power standard is dropped and the interests of the consumer statutorily protected by the substitution of that of calorific value, it appears to me that we shall be considerably hampered in the further progress of manufacture which my experiments indicate to me as being possible, inasmuch as the maximum production of gas measured in volume and heat units is accompanied by such a reduction in illuminating value as is not permissible under our existing statutory obligations.

It is a matter for congratulation that a movement has already been made in the direction I have been suggesting as so eminently desirable, and during this and last year a calorific standard has been granted to the following gas undertakings:—

Name of Company or Corporation.	Date of Act.	Illuminating Power Standard.		Calorific Power Standard.	
		Candles.	Penalty.	Nominal.	Penalty Below.
Wandsworth, Wimbledon, and Epsom District	1912	14·0	No penalty	136 gross calories	122 gross calories
South Suburban . .	1912	Nil	,,	540 B.Th.U. gross	475 B.Th.U. gross
Morley Corporation .	1913	Nil	,,	,,	,,
Porthcawl and District	1913	Nil	,,	,,	,,

The standard calorific value in the case of the Wandsworth undertaking is 136 calories gross per cubic foot of gas, and in that of the remainder, 540 B.Th.U.—the same value expressed in terms more generally understood in this country. My own Company, as you are probably aware, conducts its manufacture under a dual standard, instituted in 1909, of both illuminating power and calorific value. The illuminating power standard is 14 candles, and that of calorific value is nominally 125 net calories per cubic foot, approximately equal to 550 B.Th.U. gross. A certain margin of deficiency is permitted before liability to penalty is incurred—with respect to illuminating power an amount less than half a candle, calculated on a three days' average, and, in respect of calorific value, an amount not exceeding 12½ net calories, also on a three days' average. I need not assure you that the engineering ranks of my Company will welcome the day that brings with it the

disappearance of the necessity for further consideration of this illuminating power standard.

RETORT SYSTEMS.

With respect to the different methods by which the distillation of coal is effected, so variable are the means by which the best present possible is obtained, that it is evident any standardization of carbonizing plant is in no way likely to be attained in the near future. It is not so long since that the knell of doom appeared to have been rung for the horizontal retort, and many were the controversies as to the superior merit of the "sloper." The latter retort had many mechanical advantages over the horizontal retort, so long as the charging and discharging of retorts was effected from opposite sides of the retort-bench, although as a carbonizing appliance it was never the equal of the horizontal. The charging of inclined retorts by the action of gravity, and the readiness with which the discharge of the coke is effected, were advantages that could not be lightly put on one side, while these operations, being conducted each in its turn from one side of the retort-bench only, afforded scope for economy in the installation of both the coal-handling machinery and coke-conveying plant—advantages that went far to compensate for the additional cost of erecting the settings themselves.

With the advent, however, of improved charging and discharging machinery the bulk of the comparative advantages of the inclined retort disappeared—commencing with the Hunter-Barnett hydraulic discharger, introduced into the works of the South Metropolitan Gas Company, up to the perfection of the Fiddes-Aldridge stoking machine, by means of which the discharge of coke from a horizontal retort and its simultaneous charging with coal are effected in a single operation. The economy of the latter machine is remarkable, as by its use a single workman is easily able to effect the charging and discharging of 220 through retorts per eight hour shift. I do not, of course, include in this the opening and closing of retort lids, or the augering of pipes—operations which now necessitate labour far in excess of the actual charge and discharge of retorts. It would be unfair to refer to modern stoking plant without mentioning the excellent work done both by the Arrol-Foulis charging-machine, and the exceedingly simple and ingenious De Brouwer machine, each of which possesses a merit which so far does not belong to the Fiddes-Aldridge machine—viz., that of enabling the retort to be completely filled with coal. The claim to honours of these two rivals have, however, for some little time past been challenged by a third—the vertical retort. And now a fourth, and formidable, rival has appeared on the scene at Birmingham for the purpose of supplying gas in one of the foremost cities in our kingdom.

I am somewhat diffident in any pronouncement as to my views on the vertical retort; but that it has come to stay, if I may be permitted to use the colloquialism, is an undoubted fact. Its vertical position, in contrast with that of either the horizontal or the inclined retort, is in itself a considerable advantage, as occupying less ground space—always a point to be seriously considered when the reconstruction or extension of works is contemplated. The labour required in the operation of the intermittent type is small in the extreme; while in that of the continuous type the minimum of labour is attained. The working of the latter type is also conducted with complete absence of nuisance in the shape of smoke and grit—most desirable when the locality of the works is in a residential neighbourhood—and, while the carbonizing results of the vertical retort compare well with those of the best horizontal settings, the added advantage of the production of an excellent quality of tar is obtained with comparatively low free carbon content. My own personal experience of conducting carbonization in these retorts is of the slightest; but what experience I have had, and my observation of their operation at many works where they have been installed, clearly indicate that their introduction has marked an important step forward on the road of progress.

I believe this is also the case with regard to the introduction of the coke-oven, and particularly so since the exhibition by Mr. W. Chaney at the last meeting of the Institution of Gas Engineers of the coke produced in the Birmingham plant. It was a surprise to me, as it must have been equally to many others of our profession, that coke so closely akin in appearance and density to that made in a well-filled gas-retort of normal size could have been produced from an oven; and it will have the effect of causing similar installations to be seriously considered for works of the larger size, when extensions or reconstruction schemes are contemplated. The coke-oven, like the horizontal retort, can be used to equal advantage in the carbonization of whatever coal can be most advantageously purchased—a factor in the conduct of manufacture on a large scale which comes home with considerable force to the responsible engineers of such undertakings, and I may say particularly to myself in the capacity of Engineer to a company carbonizing an amount of coal not far removed from two million tons per annum. The economy of conducting manufacture in units of larger size than are normally used is also an attraction belonging to the coke-oven, as it is in the case of the vertical retort; while in its operation the same tendency is also noticeable towards an increase of the heat units produced, and excellency of quality in the tar.

COKE HANDLING.

Apart from reconstruction in its retort-houses, and in the adoption of the most modern retort-charging machinery, the most noticeable feature in labour-saving plant installed in the manufacturing stations of my Company during recent years has been the installation of coke handling and storing appliances. Although, due to the gritty nature of the material dealt with, the upkeep of such plant is heavy, I know of few appliances which have better justified their installation. The system adopted is an adaptation of the De Brouwer conveyor in front of the retort-house beds, leading to the foot of an inclined conveyor of the tray type, by which access is given to another conveyor of the De Brouwer type fixed above a line of elevated storage hoppers, and from which they are fed. The coke, before delivery to the storage bins, is screened for the separation of breeze and small; and, the bins being high enough for the purpose, it is delivered by gravity alone to sacks or other receptacles used for its reception by the purchaser. Such an arrangement is most economical in its operation, and the proportion of breeze is not noticeably greater than previous to the supersession of manual labour by mechanical appliances.

CARBURETTED WATER GAS.

One can hardly leave modern methods of manufacture without reference to that of carburetted water gas, of which, on an average, my Company distributes a little over 21 per cent. of its whole output. It is much to be regretted that the prime cost of the oil used in the manufacture of carburetted water gas is not counterbalanced by more than the small return for "oil-gas" tar. It is an exceedingly beautiful process, and by its means gas is produced at a particularly low charge for labour. In the plant at my Company's Beckton works, now in process of being remodelled, a single operator controls the working of a plant producing three million cubic feet of gas per day; and the only part of the process involving any degree of laborious work is the clinkering—the whole of the valves being operated from a controller stand by means of hydraulic power. The net cost of oil must always militate against carburetted water gas becoming an economical substitute for coal gas, apart from its deficiency in calorific value, which, as compared with that of coal gas, is low. The manufacture of carburetted water gas is a valuable auxiliary, however, enabling us to deal with sudden variations in demand more conveniently and cheaply than would be possible with coal-gas plant of equal productive power, and it is occasionally of the greatest possible use in limiting the output of coke at times of small demand, and lessening the amount of coal necessary to be purchased, should necessity arise. It is, too, an invaluable second string to our bow in times of emergency; and on this account alone I would certainly not omit its installation from a modern gas-works of any importance.

DISTRIBUTION.

That the need for economy in manufacture is great is an axiom that cannot be too emphatically realized. The expenses of the outdoor department of our business have of recent years shown a tendency to increase. This, however disconcerting it may be, is nevertheless necessary in present-day conditions of gas supply. A comparison of the cost of gas production and distribution by the Gaslight and Coke Company during 1902 and 1912 will show the general tendency. The figures per 1000 cubic feet sold are taken from "Field's Analysis" in each case; but the amount allocated to wear and tear for extra normal expenditure has been deducted.

The Gaslight and Coke Company.

Per 1000 cubic feet of gas sold.

Year.	Net Coal.	Manufacturing Charges (including Wear and Tear).	Distribution Charges (including Wear and Tear and Repair of Stoves and Meters).	Total.
	Pence.	Pence.	Pence.	Pence.
1902 . .	6·97	8·75	3·21	18·93
1912 . .	3·06	6·04	5·62	14·72
	−3·91	−2·71	+2·41	−4·21

The general tendency is clearly shown. While the expenses of manufacture, in spite of the considerably increased wages paid, have decreased by 2·71d. per 1000 cubic feet, those of distribution have increased by 2·41d. These are truly significant figures; but I believe that the future tendency will be for economy in manufacture to progress, and for expenses of distribution to stand. But it is well to realize the position. The comparative figures of the net cost of coal are also instructive as showing the important influence this bears on the cost of production.

CAPITAL ACCOUNTS.

Beyond these figures, however, none in "Field" are more worthy of consideration by us as engineers interested in the economical production of gas than the effect of the capital account on the ability or otherwise of an undertaking to sell its gas at a cheap rate. Examination of the statistics published in this book shows that the capital employed by the various undertakings whose accounts are quoted varied last year between 4s. 9d. and 18s. 5d. per 1000 cubic feet sold. The moral of this to the engineer is not far to seek, nor, when found, is there one more profoundly worthy of being "made a note of."

CO-PARTNERSHIP.

If I refer to the subject of labour co-partnership, so happily introduced into the gas industry by the benevolent foresight of

the late Sir George Livesey in 1889—all honour to him for having done so—it is only to regret that this method of bringing to the minds of both employers and employed the sense of their community of interest has not been more extensively adopted by industrial undertakings. My own Company has adopted the system of co-partnership with its usual excellent results, and at the present time there are in various ranks of the Company no less than 9561 co-partners, whose collective credits are now equal to £178,856. The sense of proprietorship surely makes for added interest on the part of the worker in the progress of the undertaking he serves—far beyond the measure of interest that belongs to the mere wage-earner; while the personal knowledge between employer and employed, arising out of the periodical meetings which are held for the management of such schemes, makes for a mutual understanding and regard between these classes of co-workers, the absence of which is painfully evident in the present state of labour unrest. Co-partnership may not be the ultimate panacea for the evil of industrial unrest that is in our midst, but it is undoubtedly the best remedy that the wit of man so far has devised. It is true its application is particularly suited to the condition of the gas industry, but it is in successful operation in many other industries, including that of agriculture. The Board of Trade returns show that in August, 1912, thirty-three profit-sharing schemes were in existence in gas undertakings, which number, I believe, has now been increased by two. It is my earnest hope that the consideration of the many excellencies of co-partnership may cause the movement to rapidly spread, not through our own industry alone, but throughout the industries of the country as a whole, to the benefit, not of the workers only, but of the whole community.

SOME THOUGHTS ON MODERN INDUSTRIAL PROBLEMS.

By D. Milne Watson, General Manager of the Gaslight and Coke Company.

[An Address to the London and Southern District Junior Gas Association, Oct. 10.]

In the choice of a subject on which to speak to you to-night, it is difficult to find one, probably, that has not been discussed, or at least touched upon, by others who have previously addressed you from time to time. It seemed better, therefore, to consider more generally the wider problems common to every industry at the present time, with particular reference to how they affect the gas industry, in which we are specially concerned. As one set of problems is solved, so do new ones arise—in fact, we may say that the solution of every problem is already pregnant with another.

EARLY INDUSTRIAL PROBLEMS.

The first industrial questions that confronted man were those connected with his efforts to cast off the burden of manual labour. Gradually these efforts met with success; and they resulted in the displacement of manual labour by machinery, and the hewer of wood and the drawer of water by the skilled artisan. Take any form of industrial activity, and there you will see this exemplified. The first ships that ever crossed the seas were triremes propelled by three banks of rowers, at great expenditure of bodily energy; and the result was out of all proportion to the labour. Dissatisfied with this, our forefathers applied their minds to find a solution of the difficulty; and in course of time they learnt to take advantage of the wind to propel their boats, thus effecting a saving in labour and gaining in efficiency. In the course of centuries the possibilities of steam were discovered; and seafaring men applied this new discovery to their wants. And now oil fuel, still with the purpose of saving labour, is being adopted instead of coal. Thus in all countries, and at all times, do we see man struggling with the same problems.

Or take another case. The Pyramids in Egypt were built by hand—gangs of slaves performing the work of dragging blocks of stone into position at the cost of untold exertion, suffering, and death. Modern man would move these stones by machinery without physical effort on his part. During the construction of the Panama Canal, for instance, millions of tons of rock and earth have been lifted by cranes and steam-dredgers entirely without bodily exertion on the part of the men engaged upon this work.

LABOUR SAVING IN GAS-WORKS.

Coming to our own industry, we find the same thing happening. During the last thirty years the demand for cheap gas to supply the needs of the working classes, and to compete with electricity, has led engineers and managers to instal labour-saving appliances wherever possible. When once this principle had been recognized, the machine stoker began to take the place of the hand stoker; and recent times have witnessed the practical disappearance of this form of stoking. In few up-to-date or successful works will you find a bench of retorts which has not been fitted with some form of mechanical stoker or pusher. As science has discovered how to control and use the forces of Nature, and invented new forms of machines, we have seen all these pressed into the service of the gas-works. Electric power, hydraulic power, and compressed air have all been applied to the work of displacing manual labour. The law of gravity itself has been utilized in the designing of inclined and vertical retorts.

Outside the retort-house the same thing has been happening. Coke-conveyors and coke-washers, driven by gas or steam engines, have supplanted the old methods; and in countless ways, from coke-conveyors, pneumatic rivetters, and steam hammers, down to mechanical rag cleaners, the engineer has helped to relieve the workman of the most arduous part of his work.

OTHER INGENIOUS MACHINES.

Man has, however, not been content to stop at the substitution of the machine for manual labour only, but has also, in the last few years, devoted his ingenuity to the invention of machines with the purpose of freeing himself from mental drudgery. It is years ago since the first adding machine was invented, and did the work of addition more rapidly and accurately than any human being could do it. Now a much more wonderful machine has been perfected, which accurately multiplies, divides, and subtracts, and so relieves the accountant of the most uninteresting and mechanical part of his work. One such machine can do the work of at least three clerks; and I am told by an operator that it is done with a minimum of bodily and mental fatigue. There is little doubt that these and similar machines will, within the next few years, do the bulk of the uninteresting routine work connected with account keeping. Yet another machine has been lately introduced, which is also working admirably. It is a combination of the card principle and the typewriter, and has done away with the writing-up of ledgers, and enables two clerks to do the work of three. This machine has gone a long way to solve the problem which has assailed most gas managers, of how to keep automatic meter accounts at a reasonable expenditure on clerical work.

Not long ago, I saw a wonderful machine at work in the Census Office. The principle there was a combination of electricity with the card system; and by its means the Census returns, which formerly took expert clerks five years to complete, can now be done in two by inexperienced boys and girls fresh from school. In addition to the ordinary returns, a great number of new statistics are now worked out, which could not have been done previously, on account of the large amount of work involved.

These instances could be multiplied indefinitely; but I have given enough examples to show you what important strides have been made in lightening the labour of the clerk and accountant, by doing away with the drudgery of working out complicated returns, which are a necessary part of all modern business.

On all hands this change from manual work to machine work is welcomed. We practically never now hear of any objection being offered to the introduction of machinery. I came across recently a strange case which shows how rapidly men learn to appreciate the advantages of the new order of things. A gas company, being rather pressed for gas, found they had to bring some of their hand-stoking retorts into action, in order to supplement the supply of gas. They decided to do so at works where only recently hand-work had been in use; and as they knew that a number of the old stokers still lived in the neighbourhood, they concluded that the stokers would be glad to return to their old work—especially as they complained bitterly when hand-work was discontinued. To the surprise of the engineer, after a few days they declared that hand-stoking was not fit for human beings, and refused to work any more.

THE SOCIAL ASPECT.

Having solved the primary difficulty of freeing ourselves from arduous work, whether bodily or mental, we now find a fresh set of problems awaiting us; for the introduction of machinery in so many forms has had far-reaching effects which were never foreseen by its inventors. One of the principal results has been the gradual elimination of the small business in private hands, and the growth of mammoth corporations controlled by boards of directors. No doubt, various causes have contributed to bring this about, but not the least is machinery. Machinery costs money—generally a great deal of money—and only the big corporations controlling large capital can afford to buy it.

The new set of problems brought about by the advent of great companies are social rather than mechanical; and I should like to consider for a few minutes the attempts that are being made to solve them.

Anyone visiting a manufacturing town in the Midlands or Lancashire will not be long in realizing what are the difficulties to be overcome. Rows of dull streets succeed one another; the only buildings of over two storeys being the mills, churches, public houses, and schools. All the streets look alike; and if one were not perfectly sober, one would never be able to distinguish one's own house from the house of one's 50,000 neighbours. Man has been saved by machinery from the heavy burden of exhausting, brutalizing labour, only (as those who despair would say) to become part of the machine himself; his latter state thereby being almost as bad as his first. Curiously enough, this view is emphasized at the present time by the trouble in the cotton trade, where we find men prepared to go on strike, or to be locked out, not in order to obtain higher wages, but to obtain better conditions of work. In other words, not to benefit themselves pecuniarily, but morally—to gain freedom from the organization which they think is reducing them to mere automata.

It cannot be denied that modern methods have taken away the keen personal interest that the old-fashioned craftsman felt in his

trade. The mediæval artisan, united to every fellow-worker in the same craft by the membership of his Guild, gave to his work those priceless qualities of mind-observation and imagination whereby he became practically an artist; and it is this side which has been largely injured by the introduction of machinery. How, then, are we going to replace what has been lost? This problem of modern industrialism is what faces all of us to-day. The perfect solution is in the womb of the future; but I may here show you some of the conditions necessary to its birth.

ENCOURAGEMENT AND EDUCATION.

There must, firstly, be encouraged in the workman an intelligent and personal interest in his machine; and he must be given the chance of educating himself, and rising to a position of responsibility in the works or mill. "Once a workman, always a workman" betrays a feeling which it is the duty of every employer if he possibly can to dispel. Secondly, much may be done by the formation of classes in which boys just leaving school are taught by an expert the rudiments of their trade. This instruction should be combined with attendance at classes where arithmetic, book-keeping, English composition, and mechanical drawing are taught; and in this direction the educational authorities are most willing to give the necessary assistance. This experiment has been tried by the Company with which I am connected, and has been found a great success.

In addition, the boys should be sent to do practical work alongside some competent workman, who will show them how to carry out in practice what they have been taught in theory. This stage being passed, the young workman should have facilities given him for attending advanced classes and lectures by duly qualified teachers at technical schools. Classes are necessary for the development of such qualities as salesmanship; and the boy should be encouraged to study for himself, and to enter regularly for the examinations, both in the company's classes and in the technical schools. His work may be further stimulated by the offer by the company or corporation of prizes and by promotion whenever possible. I know from practical experience that the results obtained from this have been admirable. It is interesting to note, too, how the older men are anxious to get these trained boys as their mates, as they find them more helpful than the boy who has picked up his trade anyhow. But the great thing is that it opens up a career for the boy; it widens his horizon, and it gives him hope of rising in his profession. That it does this can be proved from the letters of application which are received from boys anxious to start in the Company's training shops and classes. One little fellow writes:—

> I am asking you if I can become a gas-fitter. There are so many men unemployed simply because they have not learnt a trade, but go first as van boys or order boys, and when about 18 have been out of work. I want to be employed, not unemployed, and do not want to be like those men standing at street corners wasting their time away. I want to rise higher and higher, and become, if possible, a prominent man of England. This is why I want to become a gas-fitter.

Another writes:—

> I desire to make a start in life. Therefore on hearing and reasoning myself, I think that gas-fitting will be a good and reasonable thing to start my career in life with. My aim in life is going to be fulfilled. That is, I want to start low, then gradually but surely to raise myself to a suitable position for myself.

Yet another states:—

> I wish to enter the Company's course of training for certain reasons—namely, for the thorough good training which they give you. This Company not only teaches you theoretically but practically. Then when you have finished your apprenticeship you are turned out a good workman that can earn a living wage. Again, while training you are allowed to enter examinations called "City and Guilds," and besides the honours and certificate the Company gives prizes.

Another difficulty to be faced is the monotony of modern work. This is not an easy matter to deal with. I heard the other day of a manufacturer who thought that the work of feeding a particular machine became in course of time dull and monotonous, so he arranged to let all his men take a turn at this work, to prevent any man becoming stale. His suggestion, however, did not please the men. They said it took too much thought to change their occupation—preventing their indulgence, no doubt, in those pleasant day-dreams which were their habit. I do not know whether the employer has given up his attempt; but I hope that he has not, for it is a step in the right direction. I was pleased to learn only the other day that at certain works the men themselves are beginning to realize this, and have asked to work alternately on stoves and meters, so as to prevent the work becoming tedious and monotonous.

CO-PARTNERSHIP.

There is, however, another and greater difficulty even than monotony to be overcome in connection with modern industrial conditions—that is, the loss of the workman's personal ambition, that ambition which used to be kept alive by the hope of one day being a master himself. Further, the new system has obliterated the kindly family spirit which was present in the small workshop, where everyone was known to his employer by his Christian name. It has substituted a soulless name, such as "The Engineering Construction Company," for the personal "John Brown and Sons." In a large joint-stock business practically everyone is a wage-earner, and has no particular individuality except that represented by a number on the wages-sheet. This is a negation of a natural law of man's being. It outrages what may be called the law of family spirit; and a remedy must be found for it, if modern industrialism is to become a success. In the large business, the workman misses the friendly interest of the employer, which he found in the small one. It is said that the corporation or great company has no soul—a soul therefore must be found.

Co-partnership has been introduced into many gas companies for this purpose; and though most schemes have been at work too short a time for their full effect to be felt, I have no doubt that in co-partnership will be found the living force, the vital spirit, in short the soul that will make the dry bones live. Co-partnership gives the workman a wider view of the relation which he bears to the company. He is no longer a cogwheel in a vast machine, but an intelligent factor in the ultimate success of his company. No longer is his horizon bounded by his weekly wage; but his eye is steadily fixed—or ought to be—upon the result of the year's work in which he has a share. He finds that after a few years he has a very considerable sum set aside, without any special act of saving on his part. This is all to the good; for it is one of the cardinal principles of all co-partnership schemes that the wages must be the standard wages in the trade, and that the co-partnership bonus must be something over and above. It is not intended to discourage men from saving (most co-partnership schemes contain provisions to enable this to be done); but it must be recognized that saving is not always a very easy task for a man with a family to provide for, and co-partnership saves his money for him without any special effort on his part, beyond that of helping his employer in the economical development of the business.

When a man finds that he has a considerable sum invested in a business, he naturally becomes proud of that business, and interested in its welfare—more especially as he recognizes that the amount of the yearly bonus varies according to the success of the business, and that he may directly contribute to this success. In this way he begins to feel the pleasure the old-fashioned workman felt in his small business.

In all co-partnership schemes provision is made for committees, on which the workmen serve as members, conferring with directors and officials on questions relating to the welfare of the company. All this helps to remove the idea that the modern workman is only a wage-earner producing dividends for others—an idea which has done more to breed discontent than anything else.

There are other methods also by which the lives of the workmen may be brightened and supplied with a human interest. The encouragement of various kinds of clubs, reading-rooms, bands, and allotment gardens draws men together, and makes them feel that the company is not merely a money-making machine, but has an entity, and gives a man scope for the full display of his intellectual, social, and athletic qualities. Make a man proud of his company's cricket team, brass band, debating society, or rifle club, and you have more than half removed the disadvantages inherent to large corporations.

THE QUALITIES NEEDED FOR SUCCESS.

I have reviewed briefly some of the larger problems and some of the suggested remedies; and I have only now to enumerate the particular qualities which we should look for in the men who are actively engaged in positions where these questions arise. For it is these men, rather than the theorists, who will ultimately find a way of escape, and lead us from the present strife into the paths of peace. We all know the copy-book qualifications of the successful manager—intelligence, diligence, perseverance, honour—but of equally great importance, though not so generally recognized, are sympathy, imagination, and a sense of proportion. To make a successful manager of a large business to-day, a man must cultivate sympathy. Without this, he is not likely to understand the problems which confront him. He cannot understand why the working men are dissatisfied if he pays them good wages. He cannot see that they want that interest shown in their lives which creates the bond of brotherhood. The secret of success in dealing with various types of men is to be able to see with their eyes, to feel with their heart. The engineer at the works, the manager in his office, can with sympathy do as useful work as the philosopher, the preacher, the politician, or the poet.

Closely allied to, and almost inseparable from, sympathy is the quality of imagination. In every scientific discovery, when the laws have been applied, calculations made, and facts marshalled, it is the flight of imagination which leads to the final discovery. The actual data were in the hands of many astronomers; but it required the imagination of the young undergraduate Adams, and of the Frenchman Le Verrier, to work out the necessary calculations, and to discover the existence of the planet Neptune. The distillation of gas from coal was known to many; but it was left to the imagination of Murdoch to apply gas to lighting.

Natural phenomena are universally known, but require the touch of imagination to discover the law which underlies them. Apples have always fallen from trees; but Newton alone discovered the law of gravity. Steam has always been given off from boiling water; but Watt discovered its potentialities. So it is in the practical problems which we have been discussing. Most men were aware of the difficulties connected with our industrial conditions; but it was the imagination of Sir George Livesey which made him apply the principle of co-partnership with such success to these

difficulties. It is the man of imagination, who has not his mind obscured by the difficulties and details of his werk, who can with inner vision see the true issues, and so apply the universal law to the practical problems around him.

The third quality that I mentioned as pre-eminently necessary for the modern business man is a sense of proportion; for without it the sympathy of which I spoke just now would degenerate into mere sentiment. By sympathy we see other men's points of view. By a sense of proportion we avoid any exaggeration of a particular aspect, and unite elements apparently antagonistic into one harmonious whole. In judging a great painting, for example, more perhaps than colour or design the art critic of to-day looks for "value," for a right subordination of one part to another. The drawing may be clever, the colour full and rich; but if one detail of the picture leaps out at you, destroying all sense of proportion with the rest, you cannot call it truly a work of art.

I placed sympathy first among qualities necessary to the business man, because without it no man is able to deal justly with his fellow men; and I place "value," or a sense of proportion, last, because without it the greatest qualities are rendered valueless. Efficiency has been described as the power of seeing the whole in the part. More especially true of the manager and the engineer, it applies, only in a less degree, to every worker. A man may impede or injure the success of his department by minimizing or exaggerating the particular work in which he is employed. Each voice in a choir is needed for the melody of the whole; but the throaty tenor, anxious to display the quality of his voice, may easily ruin the harmony of a whole chorus.

I have now spoken about three qualities particularly necessary to success; but I may remind you that neither they nor any others will ensure it to you, for there is no royal road to success in business, any more than there is in anything else. In the noblest lives, history is full of "high failures," who have "o'erleapt the bounds of low successes;" and if, through faithfulness to our ideals, this kind of failure is ours, we need never be ashamed of it. We cannot forecast the result of our efforts; but we can, in the words of Sir Anthony Gloster in Kipling's poem, when asked for the secret of his success:—

"Keep our light a-shining,
A little in front o' the rest."

NOTES ON SALESMANSHIP AND ADVERTISING.

By S. A. Carpenter, of the North Middlesex Gas Company.

[An Address to the London and Southern District Junior Gas Association. Oct. 10.]

The gas engineer of to-day gives much attention to salesmanship; and it occupies an important place in the minds of administrators of modern gas undertakings. It will, therefore, be worth our while to spend a few minutes over the subject, which may be considered under three headings—the salesman; the goods; and the consumer.

THE SALESMAN.

Many qualities enter into the composition of the successful salesman, among which tact, courtesy, patience, and persistence may be mentioned. He must have complete knowledge of the article he is selling, its special uses, its advantages over competing apparatus, its construction, and its suitability for the particular requirements of the consumer. He should, if possible, have knowledge of it as an actual user; for while the prospective customer is interested in the appearance of the article, its quality, and artistic effect, yet he buys it for use, and the salesman's experience will be most welcome in helping him to a decision.

The qualities mentioned come into play when the prospective buyer has been got in touch with. But he has first to be found; and this is the most difficult kind of salesmanship—viz., obtaining new business from people who have not previously given serious thought to the matter. The little seed of interest must be sown at every opportunity, and carefully watched for any sign of germination, and a keen eye kept on the little seedlings of desire that here and there spring up, for these are capable of being nursed into full-grown orders.

The gas man is to a greater or less extent in touch with the consumers. They are not absolute strangers to him. Meetings and interviews can be made use of for preaching the gospel of gas. It will be possible in such interviews to find out what opening there is for fires, hot-water apparatus, and the like, and to sound the consumer as to the possibility of installing them, without in any way bothering him as a special call might do. This information can be stored up for future use. If interest has been aroused, a good start has been made. The power of suggestion can next be employed. By continually suggesting the desirability of any particular thing, a desire is gradually set up in the mind for its possession. The impression should be conveyed that it is the consumer's interest that is being studied—that every moment he is without the article, he is losing in comfort or convenience, and that its installation will mean increased enjoyment of life. Do not talk beyond the sale, if you would avoid an anti-climax. Once the decision has been made, any further persuasion is unnecessary and futile; and the buyer should be politely got rid of as quickly as possible.

THE GOODS.

The goods to be sold are very varied, and full of what is interesting; and their study is a fascinating one. The salesman must know all there is to be known about them. It is helpful to use some such form of analysis as is given below.

Analysis to be Applied to Types of Apparatus New to the Salesman.

What is it?
What is it for?
Its price.
Is it a necessity, or a luxury?
Comparison with competing article in convenience, utility, and saving of labour.
Its efficiency.
What class of consumer will it appeal to?
Its design.
Its construction and mechanism.
Is it cheaper to use than competing article?
If not, what compensating advantages has it?
Its hygienic aspects.
Its length of life.

With a fund of information like this to draw upon, such an interesting story can be woven around any kind of apparatus as can hardly fail to arouse interest. A selling talk can be constructed that can be adapted to all types of consumers. It should be borne in mind that it is as bad to talk too much as too little—there is still some truth in the saying that "Silence is golden." If the buyer cannot get a word in occasionally, his interest will soon flag; and this is fatal. Give him a chance to talk, and he will reveal himself, giving an opportunity for the most effective arguments to be selected and used, and the order obtained with the least expenditure of energy.

The construction of selling talks is a subject on which a whole evening could with advantage be spent. Experience will show what points strike home. It is better to get a single idea clearly and firmly fixed in a buyer's mind than for him to have only a confused general sense of a number of advantages. This applies also to any literature which may be given. A consumer with a big list dealing with a large number of types will hover over this and that illustration, wavering between one and another, and perhaps come to no decision at all, when he would readily fix on one, were the others out of the way. The salesman knows what is most suitable; let him concentrate on that one. It will save his own and the customer's time.

THE CONSUMER.

Lastly we come to the consumer. The salesman may be good, and the goods at his disposal excellent, but neither is of any use unless the buyer comes along. The customer, unlike the goods, cannot be studied at leisure, but must be read at sight. Every salesman—whether he knows it or not—is a student of character; and if he makes it a systematic study, so much the better, for he will quickly get at the point of view of the buyer, and submit a proposition to exactly fit in with what the latter has in mind.

It is said that there are two main types of character—the intellectual and the emotional; and though we may never meet a person who is all head or all heart, yet one or other is the dominant factor, and where one will base his decision on utility and efficiency, to the other appearance or novelty will be the first consideration. We find a certain number of types, and these repeat themselves over and over again; and, with experience, a glance at the dress, the hands, or the expression of the face will enable them to be labelled and dealt with accordingly.

The prospective buyer passes through four stages, which may be enumerated as follows: Attention; interest; desire; resolve. He will not resolve to give an order before the desire to have the apparatus has formed in his mind; neither will he desire it until his interest is aroused, but must be led gently on step by step.

ADVERTISING.

With advertising I propose to deal very briefly, holding it to be merely an adjunct of salesmanship. It has been said that "Advertising is a good thing, if you are advertising a good thing;" so that without doubt it is excellent in our case. Our competitors are keen advertisers, and take good care that the advantages of their commodity shall not be overlooked; so that in self-defence a certain amount of advertising is necessary. Some of the chief points about an advertisement are: The headline; the illustration; the style; the argument; the display; and the medium employed for reaching the public.

The headline should epitomize the advertisement, and should be framed with a view to arresting attention and inducing the reader to go on to the end.

Illustrations should be used as much as possible. A whole volume of meaning can be conveyed by a good picture, which will make a stronger appeal than pages of printed matter. A gas-fire of itself may not be of compelling interest; but a good picture can give an impression of cosiness and luxury which cannot be expressed in words.

The style will vary with the class of consumer it is intended to reach. What is suitable for the West-end will not appeal to the East-end, and *vice versa*.

The argument should set forth clearly and concisely the claims of the article for favourable consideration.

By the display, we understand the manner in which it is set out, and also its position in the paper or magazine.

The medium for reaching the public is controlled by the amount of money the advertiser has to spend. Advertisements in the morning papers make an appeal which is universal and convincing; for to what a man sees in the daily paper which he affects and believes to be above all others in truthfulness and accuracy of statement, he will give serious consideration. This kind of advertising can only be accomplished by joint effort, and in a general way. Local advertising through the weekly journals, parish magazines, and posters on the stations or hoardings can give information peculiar to the district.

In concluding, I would say that advertising must be truthful. The case for gas is so strong that it is not necessary to exaggerate in the slightest its good points. If the case is under-stated, the consumer finds the apparatus exceeds his expectations. All the better.

DISCUSSION.

Mr. W. M. Mason (the Secretary of the British Commercial Gas Association), on being called upon to open the discussion, remarked that it was the first time he had enjoyed the privilege of being present at a meeting of the Association; and he was glad to be there that night, as, of course, he was specially interested in advertising and publicity. He thought that in the gas industry people too often regarded advertising as one little bit, as only one section, of the undertaking, and forgot to look at it from the broader point of view that it was only one part of the general machinery, which should be considered as a whole. If he had had anything to do with the preparation of the paper, he should not have put any "and" in the title, for salesmanship and advertising were really one. Salesmanship was not merely confined to the show-room. Most of the points made in the paper were admirable, and most were perhaps more applicable to the show-room; but salesmanship was in the general manager's office as much as in the show-room. It started with the price of gas, and affected every individual unit of the gas undertaking. The boy who answered the telephone could be a good or a bad advertisement. A gas-fitter who went out to a job and did not give it the attention he might do, and did not leave the place as tidy as he should, was a very bad advertisement; and the man who was doing his best—perhaps with an eye on the co-partnership profits, but also with the higher aim of doing well the little bit left him to do—was a very good advertisement. Outside advertising was, of course, also essential, and modern men understood that selling gas was like selling sugar or soap, or anything else. It was a matter of salesmanship or advertising. It was not a question of "Shall we advertise?" but of "How much shall we advertise, and how consistently shall we advertise, and how regularly and how best can we advertise?"

Mr. S. B. Chandler said that the President's remarks afforded much food for thought. They emphasized the necessity for great attention to the sales department of any and every gas undertaking. It was, of course, true that the price of gas was a very powerful factor in the obtaining of new business; but he thought that if Mr. Carpenter's idea of a salesman was carried out, the result would be the production of a man who would be a very valuable asset to any gas undertaking. The address showed the necessity for a thorough practical and theoretical knowledge of the whole business of the sale of gas. Of course, to-day consumers were very highly educated, through the Press, exhibitions, and so on; and sometimes one came across a customer who knew nearly as much as the man who was trying to sell him the goods. Another thing he considered should be regarded as a *sine qua non* for the gas man was that he should keep his eyes upon the general law. For instance, he had come across a case where flueless gas-stoves were advised for a situation coming under the Factory Acts. With regard to advertising, it seemed to him that the British Commercial Gas Association were doing very valuable work in bringing home to the average man the advantages of a cheap and efficient method of cooking his food and warming and lighting his home.

Mr. W. E. Brown remarked that, if the argument was carried a little further, the money spent on advertising, &c., would be largely wasted if it was not followed up by good service. First of all, the policy of the undertaking was laid down by the directors, and the organization for carrying the policy into effect was in the hands of the manager, the engineer, the heads of departments, and so on. But the actual carrying out of the work fell very much to what they might call juniors. They must remember that it was upon this part of the staff that the public formed their opinion of the gas company as a business machine. If they bore this in mind, and gave the attention that should be given to an order when they got it, they would cultivate what he thought was the best form of publicity—that was, a really satisfied and contented customer. Advertisements in papers, and so on, were all very well; but there was nothing like the personal recommendation of a satisfied user. It was essential that they should take note of all the little requirements of a customer. Many might seem quite trifling and unimportant, but still neglect of them might prove irritating to the consumer.

Mr. G. F. Cox expressed agreement with Mr. Brown's remarks. They might, he said, advertise fully, but unless orders and complaints were attended to promptly and carefully, great harm would be done to the undertaking and the industry. One of the finest advertisements they could have was the fact that a consumer knew he had only to drop a card to the office and his complaint or order would be attended to at once. It was up to all of them to see that customers had this assurance. One thing which he thought often annoyed householders was to have several men calling at different times of the day to do different jobs, owing to a gas undertaking having so many separate departments. If, whenever practicable, one man and a mate were sent to do a complete job, this possible source of annoyance would disappear.

Mr. F. Ainsworth said he believed that every fitter ought to be a salesman. He had been surprised at the amount of work that some of the fitters at Ilford had been able to do in this way—for instance, in recommending people to adopt up-to-date burners and fires. They should all try to persuade their fitters to push the sale of gas as far as possible when going to houses in the course of their ordinary work.

Mr. W. J. Liberty suggested that it might be well to make it worth the while of fitters and others who went round the district to do this. They might give them an honorarium in some way—not necessarily money—to encourage them in salesmanship. He remembered one company who had a roll of honour, and gave a little money as well, for the men who got orders for the greatest number of slot-meters within a stated period. He agreed with Mr. Ainsworth that the fitter—the man on the district, and the only man the consumer knew in connection with the gas undertaking—was a great factor.

Mr. R. J. Behenna thought that anybody connected with the sale of gas or any other product would be benefited by bringing into practice the system set forth in the paper. The customer's resolve to have an apparatus was all very well; but gas people should carry the matter two steps further than this. After they had sold or hired out an article, they wanted to give satisfaction and to continue to give satisfaction. Thus would the consumer get the confidence in the company and the officials which would lead him to always regard them in a friendly manner, and it would not be necessary in the future to go again through the primary stages of salesmanship with him.

Mr. D. Milne Watson (who occupied the chair during the delivery of the address and the discussion upon it) said he had been much interested in the President's remarks, which had developed fully the whole question of salesmanship, which had lately been occupying so prominent a place in their thoughts. The discussion, too, showed that the points had been taken, and the address had not been wasted. Such gatherings as this were of the greatest use, especially as men from all departments were brought together in a bond of union, and were made to feel that each and all were necessary adjuncts to the gas company's business. "No departmentalism" was a good motto to follow; and they would all be better for remembering this.

Hints on the Prevention of Accidents.

We have received from the United Gas Improvement Company of Philadelphia a copy of a useful book they have just published bearing the title of "Accident Prevention: Safety First." It is an amplified revision of an illustrated talk, on the prevention of accidents in certain public utilities, which took place at the annual meeting of the National Electric Light Association held in Chicago early last June. The author (Mr. James B. Douglas), in his preface, points out that, notwithstanding the constant endeavours of workers in the field of accident prevention to bring the subject of safety effectively before employees by means of talks and demonstrations, there has been difficulty in doing it in forms they could understand and readily bring into use. This difficulty it is the object of the book to remove. Though it has been prepared for the use of managers, the nature of the conditions to which attention is drawn is such that the illustrations, which are very numerous (there being one on practically every page), should prove of value to foremen and employees in general. They are taken from a collection used in the form of lantern slides, which were found, in conjunction with moving pictures, to be the best way of impressively bringing home to employees the various risks to which they are liable. While it is, from a humanitarian point of view, desirable to prevent accidents, the author says it should always be borne in mind that "an accident avoided means money saved, efficiency undisturbed, and production uninterrupted." At the end of the book an illustration is given of the "pulmotor," which the company have installed at their various works, and the use of which has been found remarkably successful in accidents in gas-works, as well as in cases involving suspended animation.

"The Management of Public Electric Supply Undertakings" is the title of a book by Mr. A. Hugh Seabrook, M.I.E.E., M.I.Mech.E., the General Manager of the Electricity Supply of the St. Marylebone Borough Council, which has just been published by the "Electrical Times," Limited, of Sardinia House, Kingsway, and of which we have received a copy. During the past winter, the author delivered at the East London College a series of lectures drawing attention to the commercial aspect of the business of electricity supply; and the material from which they were prepared has been arranged in book form in order to draw further attention to the subject. Some of the lectures were referred to in "Electricity Supply Memoranda" at the time of their delivery; and an opportunity will be taken to deal further with them in a subsequent issue of the "Journal." The price of the book is 7s. 6d. net.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Opening Meeting.

The Opening Meeting of the 1913-14 session of the London and Southern District Junior Gas Association was held last Friday evening, at the Westminster Technical Institute, Vincent Square, S.W. Mr. S. A. CARPENTER (North Middlesex Gas Company), the President, occupied the chair; and there was a very gratifying attendance of members to listen to the two addresses that were delivered. The presence of so many patrons, especially, was remarked upon by the President as being a pleasing feature, as it showed what a keen interest they took in the welfare of the Association. Several who were unable to attend wrote expressing regret, and wishing the Association success.

MEMBERS' SUCCESSES.

The PRESIDENT, at the outset, said two members of the Association merited their hearty congratulations. Mr. J. H. Donaldson had been appointed Engineer of the Sevenoaks Gas Company; while Mr. H. C. E. Gripton, of Windsor, had been remarkably successful in the City and Guilds of London examinations.

MODERN INDUSTRIAL PROBLEMS.

The PRESIDENT, in calling upon Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, to fulfil his promise to address the members, said it was most encouraging to the Association that a gentleman occupying Mr. Milne Watson's position should take so keen an interest in them.

Mr. D. MILNE WATSON thereupon delivered an address entitled "Some Thoughts on Modern Industrial Problems." This will be found on p. 148.

The PRESIDENT, at the conclusion of the address, remarked that Mr. Milne Watson had given them a very vivid picture of the industrial conditions of the present day. There was undoubtedly a tendency for the old-fashioned workman, who was a very picturesque person, to disappear, and in his place they were getting a large number of men who were perhaps not artists, but were very thorough workmen. The work the Gaslight and Coke Company were doing in training lads who would otherwise become van-boys, and so on, and teaching them suitable trades, was an admirable one. They would remember what they had been told—that the secret of success was to promote good feeling between employer and employed, and that they should be able to see with the men's eyes, and feel with their hearts.

Mr. J. HEWETT (Senior Vice-President), in proposing a hearty vote of thanks for the address, said it was extremely gratifying to the Association to be favoured by a visit from Mr. Milne Watson, and to receive from him an address of the character of that to which they had just listened. It was full of good things; but he had been particularly struck with the survey of the attempts of man to overcome the necessity for laborious work. They must not, however, lose sight of the fact that the various labour-saving appliances—such as calculating machines, and so forth—all tended to one end. They made it far more difficult for the ordinary man to qualify for a really responsible position. Under these circumstances, it was up to every one of them, as members of an Association of this kind, to do their best to make themselves efficient; so that, if they were fortunate, when the time came for them to take up any responsible positions they would be able satisfactorily to do so. Mr. Milne Watson had referred to the monotony of machine work; and when the members had been visiting different manufacturing works they had been much struck with this. He was surprised to hear that when certain men were offered an opportunity of changing their job, they did not care to do so. One would have thought they would have been pleased to change about, as they would thus have educated themselves in several directions, besides relieving the monotony. The Association had been treated to an address of a highly instructive character, and he asked them to accord Mr. Milne Watson a very hearty vote of thanks for it.

Mr. D. J. WINSLOW (Immediate Past-President) seconded, and remarked that they were very fortunate indeed as an Association in having Mr. Milne Watson to speak to them. He had given a very inspiriting address, and one which would furnish them with good food for thought. Personally he had been much struck by the human element in the address, and by Mr. Milne Watson's great knowledge of the average workman. They must remember, too, that they had not only to thank Mr. Milne Watson for his address, but for his valuable help in the past. He had warmly supported the Association right from the start, and had always been anxious to forward the educational side of the work by permitting visits to works, &c. No doubt it was for the good of the industry that such an Association as theirs should prosper.

Mr. J. N. REESON (of the Gaslight and Coke Company) said it was not his intention, when he came to hear his revered chief Mr. Milne Watson deliver his address, to add any remarks of his own; but as the President had asked him to say a word or two, he would do so. The members were fortunate indeed in having a gentleman like Mr. Milne Watson to give them the opening address of the session. To those who knew Mr. Milne Watson, as he had had the privilege of doing for some long time, this good fortune was apparent. The members were generally accustomed to hear discourses, he thought, from engineers—men who had to deal with the practical part of the profession—and they did not often have addresses from gentlemen in the position of Mr. Milne Watson. He had no doubt they had been struck, as he himself had been, by the intensely intimate grasp that Mr. Milne Watson had, not only of the human side of the labour question, but also of the practical side—the side that they might quite well have excused Mr. Milne Watson for not interesting himself so much in. But those who knew him were aware that, not only was he the General Manager of one of the largest corporations in the world, but he also had an intimate hold on the details in all the departments of the vast business. What he would like particularly to draw the attention of the members to were the remarks made by Mr. Milne Watson as to dealing with the workman in a humane way; and as most of those present would have to deal with workmen, they would perhaps pardon him for adding a word to those already spoken. If they treated a workman as a human being, they need have no fear. The British working man, he believed, was at heart a good sort. "When he was good, he was very, very good; but when he was bad, he was horrid." And he was only bad when made bad by no consideration being given him.

Mr. J. E. HENWOOD (of the Gaslight and Coke Company) expressed his pleasure at being afforded an opportunity of supporting the vote of thanks to Mr. Milne Watson for his encouraging address. He (the speaker) felt very strongly the remarks that had been made with reference to sympathy. There was a tendency nowadays for a man in a large company to feel that he was so small a unit in the undertaking that he was lost sight of. But he (Mr. Henwood) knew from practical experience that with their Company no one need feel this if he took a proper interest in his work. He knew that Mr. Milne Watson was always ready to see anybody, no matter how humble a position he occupied, and was prepared to hear what he had to say. When this was the case, a man was much more likely to be interested in his work, and to give his best to the undertaking he served.

Mr. W. J. LIBERTY also supported the vote, and echoed what had just been said as to their good fortune in getting Mr. Milne Watson to give them so much of his time—especially now, when there was very great stress of work. Many of them would leave the meeting with ideas which they would put into practice in their work. They must not forget how much they owed the Gaslight and Coke Company in connection with the revival of the apprenticeship system. There was not a better thing they could give a man than some responsibility. Only make him think that to some extent the business depended on him, and then he would take the interest in his work which they all desired. He hoped the address would be circulated even beyond the Technical Press. The more it was studied by employers of labour and by the workmen themselves, the better it would be for the world at large.

The vote having been carried by acclamation,

Mr. MILNE WATSON said he regarded it as an honour to be asked to come and address a body of technical men. He felt at least that, if he could not enlighten them upon any engineering question, it would be interesting to consider some of those problems which, whether as engineer, manager, or secretary, they would be bound to face. It always seemed to him that the preparation of an address of this kind helped to clarify one's mind, and therefore the writer was benefited as much as, if not more than, his audience.

NOTES ON SALESMANSHIP AND ADVERTISING.

The PRESIDENT then delivered a short address which dealt with the important subjects of salesmanship and advertising. This was really in the nature of a paper, and it was followed by a practical discussion. The address, and some notes of the remarks to which it gave rise, will be found on p. 150

Mr. J. G. CLARK proposed a hearty vote of thanks to Mr. Carpenter for the address; remarking that the Association was representative of all the departments that went to make up a gas undertaking, and the presentation of papers from various branches assisted—enabling other departments to see things from a broader point of view. Interchange of information between the different departments might with advantage be further cultivated. The price of gas could be reduced by economies in manufacture; but salesmen could also do it by increasing the consumption.

Mr. G. H. LLOYD seconded, and pointed out that it was often the attention paid to small details that was the means of securing a permanent consumer.

The vote was cordially passed, and briefly acknowledged by Mr. Carpenter.

PROGRAMME ALTERATIONS.

The PRESIDENT said that, before adjourning for light refreshments, he might inform the members that slight alterations had been found necessary in the programme. The paper arranged to be read by Mr. F. S. Larkin on Nov. 21 would (owing to this date clashing with a lecture by Dr. Rudolf Lessing) be given a week later; and the visit to the Birmingham works of Messrs. John Wright and Co. would be the subject of an announcement later.

The Vertical Gas-Retort Syndicate have received from the Wellington (N.Z.) Gas Company a repeat order for an installation of Dessau vertical retorts, comprising six beds of eighteen 4-metre retorts (1912 model), making 108 retorts in all, complete with the necessary coal and coke handling plant. This, we learn, brings the total number of retorts erected or on order up to 12,264, and the number of repeat orders to 36.

NOTES ON GAS MANUFACTURE, &c.

THE KOPPERS CHAMBER OVENS AT BIRMINGHAM.

By W. H. Johns, Superintendent, Saltley Gas-Works, Birmingham.

[Presidential Address to the Midland Junior Gas Association, Oct. 9.]

I thank you most sincerely for the honour you have conferred upon me in electing me to the position of your President for the current session. I realize the great responsibility attached to the office, and hope I may, with your kind co-operation (on which I know I may rely), be able to maintain the Association in the elevated position it occupies to-day among Junior Associations.

NATIONAL GAS EXHIBITION AND CONGRESS.

On the 18th inst., a combined meeting of the Junior Gas Associations is to be held at the National Gas Exhibition, for which a splendid programme has been arranged. The exhibition promises to eclipse all that have gone before, and to have a far-reaching effect on the gas industry, and benefit all connected with it. As you are aware, the exhibition has been organized by representatives of the Institution of Gas Engineers, the Society of British Gas Industries, the British Commercial Gas Association, and patronized by municipal and private gas undertakings of the United Kingdom, and even by some of the Colonial gas undertakings, to celebrate the centenary of gas supply and the jubilee of the Institution of Gas Engineers. That we shall all benefit, goes without saying; and I hope we shall be fully represented on this important occasion.

AFFILIATION OF JUNIOR ASSOCIATIONS TO THE INSTITUTION.

I venture to suggest that the Institution of Gas Engineers be approached by a Committee appointed by the Junior Associations, to enable the latter to be represented on the Council of the former: the present being an opportune time when amalgamation with the parent Institution might be considered. Much useful work has been done by the Junior Associations among the juniors; but I feel that they are capable of doing still more important work in the interest of the great industry which they have the honour to serve, if a closer bond of union existed between them and the premier body. I am aware that this subject has previously been considered; but no steps have been taken, to my knowledge, to put the matter on a practical footing. The juniors are the only members of the gas industry who are not linked-up to the main body; but surely this is a fault for which they are alone to blame. I therefore trust that the matter will receive the attention which it deserves by the members of the Joint Council of the Junior Gas Associations, and steps be immediately taken to make the chain complete.

EXAMINATIONS IN "GAS ENGINEERING" AND "GAS SUPPLY."

Considerable difference of opinion has been expressed as to the suitability of the subject-matter contained in the syllabus of the City and Guilds "Gas Supply" course. This was evidently realized by the Institution of Gas Engineers last year, inasmuch as two papers were submitted—the one dealing with "Gas Engineering," and the other with "Gas Supply."

With regard to the former, I have very little to say, beyond agreeing with Mr. Glover's remarks that "it may be advisable to require candidates for the Grade I. Examination in 'Gas Engineering' to first of all pass an elementary science examination in chemistry and mechanical engineering, and candidates for the final examination in 'Gas Engineering' to qualify by first passing Stage II. similar science examinations." Such preliminary qualifications would tend to level-up the quality of the work submitted for examination, and make the examiners' tedious work easier. As a teacher in both gas engineering and gas supply, I can endorse all that Mr. Glover has written on this point, and can add that, from the teacher's point of view, this suggested arrangement is much to be preferred to the existing one. I have often found on opening night that many of the students who present themselves have little or no knowledge of chemistry, and frequently have never even made a sketch in their lives. Mechanical engineering is to them quite beyond understanding; and even arithmetic needs much revision in many cases. When such unprepared students present themselves, one of two evils has to be adopted by the teacher. On the one hand, he may have to leave these students to pick up what they can of the subjects referred to, which can, to say the least, only be a smattering, and consequently such students are initially handicapped when compared with those who have previously made themselves competent in such work; or, on the other hand, the teacher may, if he decides to assist such backward students in these studies, prejudice the chances of his other and more scientifically trained students by his inability to cover all the ground he would otherwise have been able to do. Which class of student is he to assist? The answer seems to me to be covered by Mr. Glover, that unprepared students should not be accepted for tuition in gas engineering classes, and certainly should be debarred from sitting for the examination until they have passed in the necessary qualifying subjects.

For the examination held in the year 1912, I assisted over 100 (gas engineering and gas supply) students in their studies, and found a very marked difference in the work submitted to me for correction each week. Probably I gave the backward students more attention than those better trained; and I can honestly say they gave me more work in return. But even though they commanded more of my time, I was always aware that their chances of success were far less than those of the neglected (?) students. That a good percentage passed is quite correct, although the general standard of successes would doubtless have been higher had they all received the same attention. Notwithstanding, no less than five medals out of eight awarded fell to these particular students; but needless to say the medallists had fitted themselves in the qualifying subjects before taking up the gas engineering and supply courses.

Greater difficulty is experienced with the students who present themselves for gas supply. Here we seem to have two or three grades or classes of students. This is evidently brought about by many unscientifically trained, though practical, men presenting themselves for study, and ultimately for examination. A practical examination combined with a theoretical one would be more fitting to such a class of student; and I am of opinion that greater benefit would be derived by the gas industry, if a practical examination could be arranged for such students.

Why not have one examinatian, a theoretical one, called "Gas Supply," and another, practical and oral examination, to be named "Gas-Fitting"? I am sure more beneficial results would accrue if such could be initiated; and the practical man would then come more to the front. The certificates awarded for "Gas Supply" under the present conditions are quite useless. Who would think of employing a man as a gas-fitter with only a certificate to show as to his ability? When a fitter applied for a situation, the first thing that a foreman would do would undoubtedly be to test him by a practical examination; and probably on this alone would he be judged, though his chance of obtaining the position would be advanced if he held a certificate in "Gas Supply," as compared with an applicant who did not hold one—all other things being equal.

The present course of study, especially in the final grade, is far too difficult for the average gas-fitter, unless a good grounding has been given in light and heat, mechanics, and drawing; and even a knowledge of chemistry and electricity is necessary to enable candidates to satisfactorily answer some of the examination questions that have recently been set. The Institution of Gas Engineers, working in conjunction with Sir Philip Magnus, of the Department of Technology of the City and Guilds of London Institute, have, however, now arranged a three years' course for gas-fitters which covers the work of the fitter; but the certificate would be of much more value if a test of the candidates' practical work could be made, in addition to the written examination.

It now appears that a re-arrangement of the class syllabus is necessary, and that teachers must be prepared to coach two classes of students—(*a*) those for gas fitters, and (*b*) those for more advanced students taking "Gas Supply." The question is a complex one, and needs the closest attention of all who have an interest in the education of the gas-fitter.

RETORT-HOUSE AND CARBONIZING NOTES.

The most important part of a gas undertaking is undoubtedly the carbonizing plant, as it constitutes the whole mainspring of the subject of gas manufacture; but which is the best carbonizing system to adopt is a question not so readily answered. Horizontal retorts fully charged, intermittent and continuous systems of vertical retorts, and chamber-ovens all have their advocates—and rightly so, for what may with advantage be adopted at one place would be totally unsuitable at another, and before a choice can be made exhaustive inquiries, inspections, and tests must be carried out. It is not my intention to occupy your time to-day describing systems of intermittent and continuous vertical retorts, or horizontals fully charged, though all three systems are at work in Birmingham, and much information could be given if time permitted. Also it would be unfair to the authors who have promised me papers this session on the Dessau vertical retorts and the Woodall-Duckham vertical retorts in Birmingham. Again, we are to visit both the installations referred to; and to make our tour of inspection complete, a visit has been arranged to view the Glover-West vertical retorts at Leicester, and the Koppers chamber-ovens at Saltley. I will therefore confine my remarks to the latter system, with which I have been closely associated; but, before doing so, would like to draw your attention to another point in connection with retort-house working.

FURNACE CONTROL—BROOKE'S PATENT AIR-SLIDES OR REGULATORS.

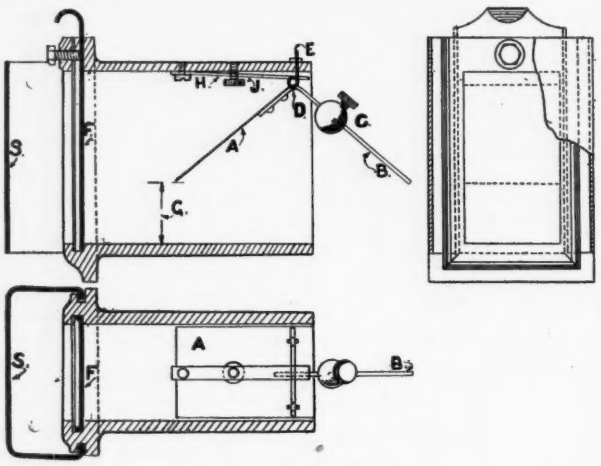
As the retort-house may be taken as the most important part of a gas-works, so may the producers or furnaces be looked upon as the most important part of the retort-house. When it is remembered what effect an apparently trivial alteration in a furnace has upon the heat of a setting, to say nothing about the effect on the fuel account, it will be obvious what enormous influence the proper care and working of the furnaces must have upon the results of carbonization. I am aware that Dr. Davidson has recently drawn attention to Brooke's patent air-slides; but as the

saving in fuel by the use of such slides is so enormous, I ask to be allowed to bring the matter before you to-day.

It is well known that the amount of primary air admitted through the ordinary fixed air-slides varies very considerably according to the depth and nature of the fuel-bed, the amount of clinker in the fire, and changes in the chimney draught; and that these changes are so frequent that it would be practically impossible to compensate for them by adjusting the slides by hand. The percentage of secondary air admitted through the fixed slide also varies very considerably; the amount increasing as the chimney draught, or the resistance of the fire to the passage of the primary air, increases, and *vice versâ*. After clinkering, when the fire is clear, and often low, there is usually a very considerable excess of primary air. This results in waste of fuel owing to (*a*) formation of poor producer gas, (*b*) overheating of the fuel, and formation of clinker, and (*c*) killing the "pull" on the secondary air by flooding the combustion chamber with an excess of producer gas. This results in a large amount of CO passing into the regenerator unburnt.

The objects of Brooke's patent air-slides or regulators are: (1) To save fuel. (2) To maintain a more constant temperature in the setting. (3) To avoid the excessive formation of clinker, and thus save labour, and prolong the life of the furnace-linings. To obtain this, the regulators are so adjusted that the amount of primary and secondary air admitted at any time is practically constant, ensuring almost perfect combustion at all times.

The apparatus consists of a vane A attached to a rod B, on which moves an adjustable balance-weight C. A spindle D attached to the top of the vane rests in two small hook-bolts E. This kind of bearing allows the vane to be easily removed for adjustment, offers very little resistance to the motion of the vane, and is not liable to clog with dust. A flat spring H, secured at one end to the cast-iron box, presses on the spindle; the amount of pressure being regulated by means of the adjustable screw J.



Brooke's Patent Regulator.

A damper plate F, for use when shutting-down or starting-up a bed, and a shield S to protect the vane from sudden draughts, complete the apparatus. The regulators are made to fit into the existing flues, or else to bolt on to the clinkering doors. The following information may be found useful in setting the regulators to work.

Initial Setting.—Ascertain the correct area of the primary and secondary air openings required with fixed slides when the bed is working correctly. Fix the primary air regulators in position, the angle between the rod and vane being set at about 100°. Then reduce the fixed secondary air slides about 10 per cent., and open the damper F to the full extent. First set the vane so that a blue flame is visible where the waste gases enter the regenerator, and then gradually reduce the primary air opening G, by moving the balance-weight C nearer to the spindle until this blue flame just disappears; care being taken after each adjustment to so regulate the pressure of the spring H that the vane will return to exactly the same position when displaced ever so slightly. The retort temperatures must now be carefully watched, and if there is any appreciable alteration the primary and secondary air openings must be increased or reduced accordingly. Clinker the fire once after fixing the primary air regulator, and then double the period between the clinkerings.

Final Adjustment.—Immediately before clinkering, examine the vanes to see that they are perfectly free, measure the openings, and analyze the waste gases at the entrance to the regenerators. Repeat after clinkering. If the angle between the rod and the vane is correct, these two analyses should be practically the same. The area of the opening will be found to be less after clinkering than before. If, after clinkering, there is appreciably more oxygen in the waste gases than before, it points to the fact that the vane has been drawn down too much with the increased vacuum in the flue. To remedy this, the angle between the balance-rod and the vane must be slightly reduced, and the balance-weight adjusted until the blue flame disappears. After two or three tests, the desired angle will be found, and will not require any further alteration. The angle should be noted for reference.

It is important to note that, with ordinary fixed slides, it is the custom in most gas-works to work with 1 or 2 per cent. excess oxygen in the waste gases, in order to ensure complete combustion at all times. With Brooke's regulators, it is unnecessary to do this, as the composition of the waste gases remains practically constant. It is therefore advantageous to cut the oxygen down to a minimum.

The following are the results of a test made by the author at Saltley on a bed of retorts fitted with primary air regulators only—the secondary air being supplied in the ordinary way—compared with an exactly similar bed working with ordinary fixed slides.

	With Regulators.		Without Regulators.
Duration of test	8½ days.	..	8¼ days.
Average temperatures of retorts, taken with Féry pyrometer. .	1990° Fahr.	..	1990° Fahr.
Period between clinkerings . . .	48 hours.	..	24 hours.

The saving in fuel on the average was 1¼ retorts of coke (5·85 cwt.) per day. The coal was not weighed; but the charges were kept as nearly as possible equal. The coal carbonized was 9 tons 7 cwt. per 24 hours in each bed; saving of coke, 3·1 lbs. per 100 lbs. of coal carbonized.

Unfortunately, we were not able to get many gas analyses during the test; but the following results of waste-gas tests at the commencement of the fuel test illustrate how well the regulators do their work.

	With Regulators.			Without Regulators.		
	Just before Clinkering.		Just after Clinkering.	Just before Clinkering.		Just after Clinkering.
CO_2 . . .	17·40	..	17 50	18·70	..	17·30
O	1·70	..	1·50	—	..	0·05
CO	—	..	—	—	..	3·90

It will be noticed that with the regulators there was practically no difference in the waste gases before and after clinkering, after a 48 hours' run; whereas without the regulators there was a large excess of CO after clinkering, though the fire had been clinkered 24 hours previously. It also shows that the fuel economy might have been still more, had there been a little less secondary air on the bed with the regulators. Still better results would no doubt have been obtained, had the secondary air been governed as well as the primary air.

You will readily see that, if only the primary air is governed to a constant quantity, any increase in the chimney draught will result in an excess of secondary air, and *vice versâ;* so that in such cases it would be advisable to keep a close watch on the chimney draught.

COKE OR CHAMBER OVEN CARBONIZATION.

I do not propose to deal with the early history and development of coke-ovens, but shall confine my remarks to the construction and practical working of the latest type of carbonizing chambers, as adopted on the Continent, and recently in this country, at the Saltley Gas-Works, Birmingham. In the 1907 "Transactions" of the Institution of Gas Engineers, much valuable information may be obtained in connection with coke-oven practice; but until Mr. W. Chaney, the Engineer of the Saltley Works, read his paper in June last, few figures were obtainable as to the suitability of this system of carbonization for gas-works purposes in this country.

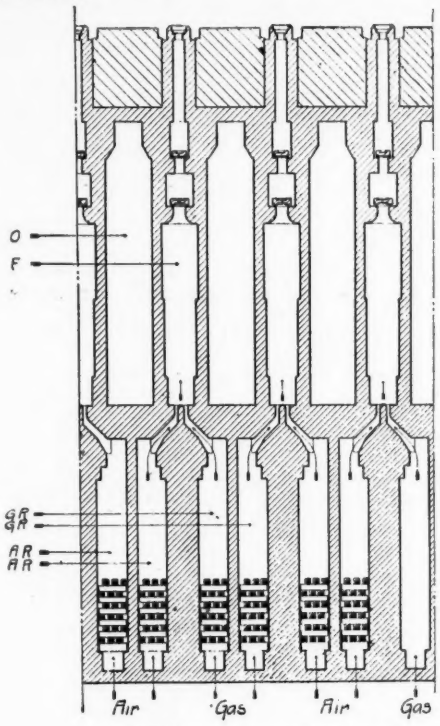
For a number of years on the Continent the surplus gas from coke-ovens situated at collieries has been supplied to many gas undertakings; but latterly the tendency has been for the gas undertakings to erect their own ovens, which have been specially designed, mainly for the production of gas, and at the same time to produce metallurgical coke as a bye-product.

KOPPERS CHAMBER-OVENS.

The Koppers regenerative chamber-oven is of the vertical flue type. The oven is a chamber 10 metres long, 2 metres high, and about 0·5 metre wide. [1 metre = 3 ft. 3⅜ in.] The sides are tapered from one end to the other, to facilitate the discharge of the coke; and each oven is capable of taking a charge of from 8 to 10 tons. The average charge at Saltley is 8 tons 15 cwt. The method of heating is by means of Mond gas (hereafter described); and the means adopted for distributing and regulating the supply of gas, as well as the method of preheating the air required for combustion, are special features of the Koppers system. The gas and air for combustion are separately distributed on each side, and along the whole length, of the oven; and combustion is caused to take place in each vertical flue. Each oven wall is formed of thirty vertical flues; and there being a gas-jet in each flue, each oven is heated at about sixty points—thus ensuring equal heating. At the top of the oven, and all over the vertical flues, openings are provided for giving access for inspection and regulation.

Very simple means are provided for the regulation of the combustion in each flue, which is such that it is easily possible for the walls of the oven to be absolutely uniformly heated from end to end. Uniformity in the heating of the ovens not only results in the production of a homogeneous coke, but enables the charges of coal to be burnt-off more quickly than in ovens where such uniformity does not prevail, besides which it effects great economy in the consumption of the heating gas. The air for combustion is heated to a high degree in regenerators designed on Siemens principle. Each oven is entirely independent of its neighbour,

inasmuch as a separate regenerative chamber is employed; and this construction permits of the air for combustion and the chimney draught being regulated separately. It will be noticed that each regenerator is divided into two sections by a 4½-inch partition wall.



Koppers' Cross Regenerative Gas Oven.

The secondary air regenerators A R alternate with the gas generators G R. On each side of the ovens are a series of vertical flues forming the combustion chamber F, also divided by a centre wall. The air and the producer gas flow through the chequer brickwork, meeting at the bottom of the vertical flue; the products of combustion passing through the vertical flues F into the common horizontal flue immediately above, over the centre division wall, down the corresponding flues on the other side, and through the regenerators into the main flue. Such an arrangement renders it necessary to reverse the heating process after a period of time (usually every half hour), so that preheating of both the Mond gas and secondary air may be effected.

The regulation of the gas to the ovens is carried out by means of adjustable feed-cocks fitted with indicators, and by increasing or decreasing the pressure of the Mond gas supply from the producers, by varying the blast pressure; and the secondary air supply may be increased or decreased by the adjustment of metal strips over the secondary air intake castings. In the illustration, the position of the oven is indicated by the letter O.

The chambers are charged by means of a machine which runs on top of the setting. This machine has three hoppers, charging into corresponding openings in the chamber; and the coal is then levelled by another machine which travels alongside the setting. This latter machine also carries a ram, by which the mass of coke is discharged from the oven into a quenching machine. Working with a charge of 10 tons of coal per oven, a carbonization period of 24 hours is required; and at the end of this time the charge is quite burnt off. The coke contained is of excellent quality; and owing to the minimum amount of handling it undergoes, very little breeze is produced. The efficiency of the machinery is such that each oven can be completely discharged, charged with 10 tons of coal, the ascension-pipes cleansed, and the oven working again in less than 10 minutes.

When the production of metallurgical coke is desired, the above method of charging gives way to a charge of disintegrated coal, which is compressed in a bunker attached to the charging machine (arranged under the disintegrated coal-storage hopper on the machine), by means of an automatic reversible electro magnetic stamper. The whole machine—*i.e.*, the stamper, with bunker and storage hopper—is electrically operated, and runs on rails in front of the chamber ovens, as shown in the illustration.

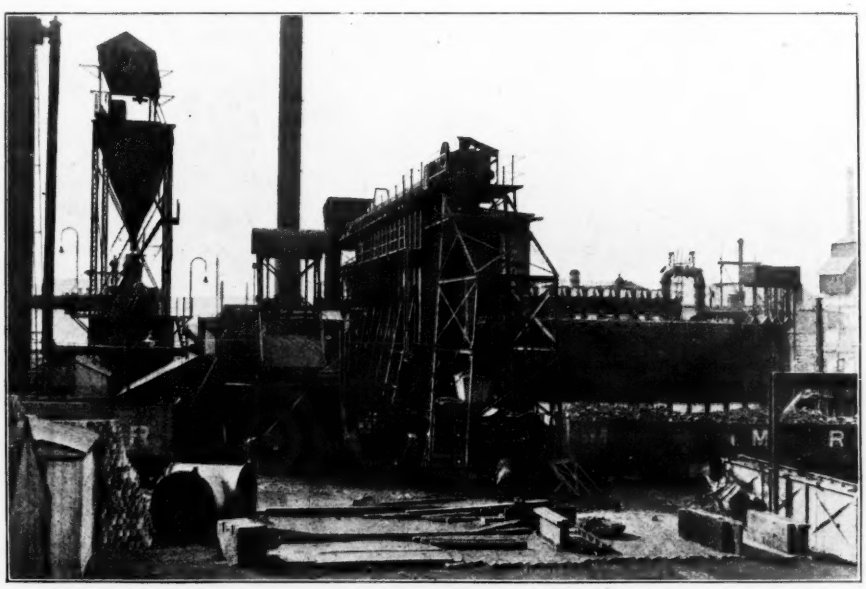
Working on the opposite side of the ovens to the stamping and charging machines, of which we have two, are the two electrically operated rams, which push the coke from the ovens into Goodall coke-quenchers, in which machines the coke is automatically quenched, screened, and loaded direct into railway waggons or canal boats. In connection with this plant, you will notice when the installation is visited next month that electricity is very largely employed—in fact, the whole of the coal crushing, disintegrating, elevating, and conveying machinery, the six machines employed on the installation (namely, stamping and charging machines, rams, and coke-quenchers), together with the pumping machinery, &c., are all electrically driven. Motors of over 900 H.P. have been installed for dealing with the various operations. The current is generated by two 200 K.W. alternators, running at 375 R.P.M., each driven by a Bellis and Morcom vertical compound steam-engine. Current may also be obtained from the Corporation Electricity Department, if found to be necessary at any time; and for this purpose a 250 kilo transformer has been installed, which is capable of transforming from 5000 volts to 440 volts the voltage worked in the whole installation. Electricity is employed for lighting the machines, and in places where naked lights are to be avoided.

It is not my intention to give any figures beyond particulars of gas analysis and the results of a seven days' test, as such information was very fully furnished by Mr. Chaney in his paper to the Institution of Gas Engineers in June, to which I would refer you. The adoption of coke-oven plant in the larger works may be confidently looked for (on account of the low carbonizing costs which are to be obtained), where the class of coke which is produced may be readily disposed of. This should be an easy matter in towns situated near blast-furnaces, and in industrial centres, such as Birmingham.

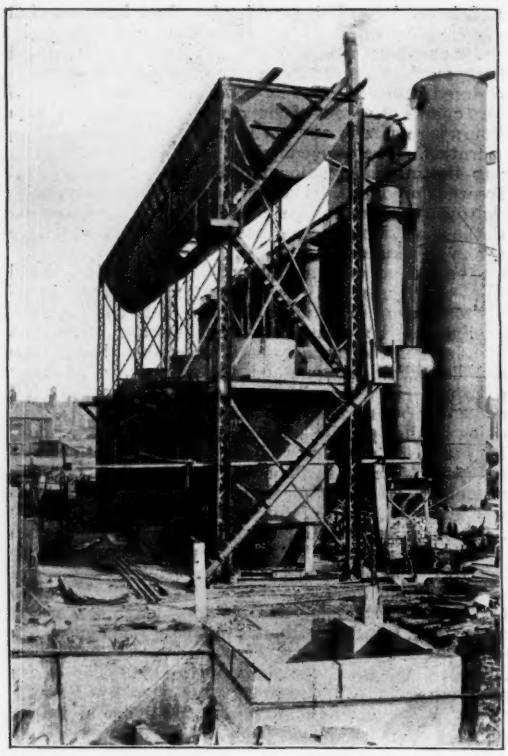
METHOD OF HEATING-UP AND WORKING OF CHAMBER-OVENS.

A few notes on the method of heating-up and working of chamber-ovens may perhaps be of interest, as it differs from the method adopted in ordinary retort-settings. Also the notes may be found useful to those who are engaged in the working of such ovens, and to those who contemplate their adoption.

The heating-up of newly-built ovens to a dark red heat (to about 500° C.) should never be brought about by means of producer gas, as over-heated places are easily brought into being, and thereby unequal expansion of the refractory material ensues.



EXISTING BATTERY OF TWELVE KOPPERS OVENS, SHOWING THE STAMPING AND CHARGING MACHINE, THE GOODALL COKE QUENCHER, AND THE MOND GAS PLANT.



The Mond Gas Plant for Sixty-Six Ovens in Course of Construction—Four Producers.

[The Fifth Producer will be erected later, from existing Oven Plant.]

The most satisfactory method of heating-up is that generally adopted at coke-oven works—namely, by "direct-firing" in each chamber by means of coke, followed up by a gradual final firing. The heating-up of the chambers falls under three headings: (*a*) The drying-out of the chambers, (*b*) the preliminary firing, and (*c*) the final firing.

Drying-Out.—The drying-out of the chambers takes at least fourteen days. The fires must be kept low, and the admission of air be very liberal. The regenerators must be connected-up to the chimney, and the chimney dampers should be fully open. By this means, the moisture in the refractory material is driven off gradually. The plug stoppers over the vertical flues should next be examined; and when found to be perfectly dry, the preliminary firing may be proceeded with.

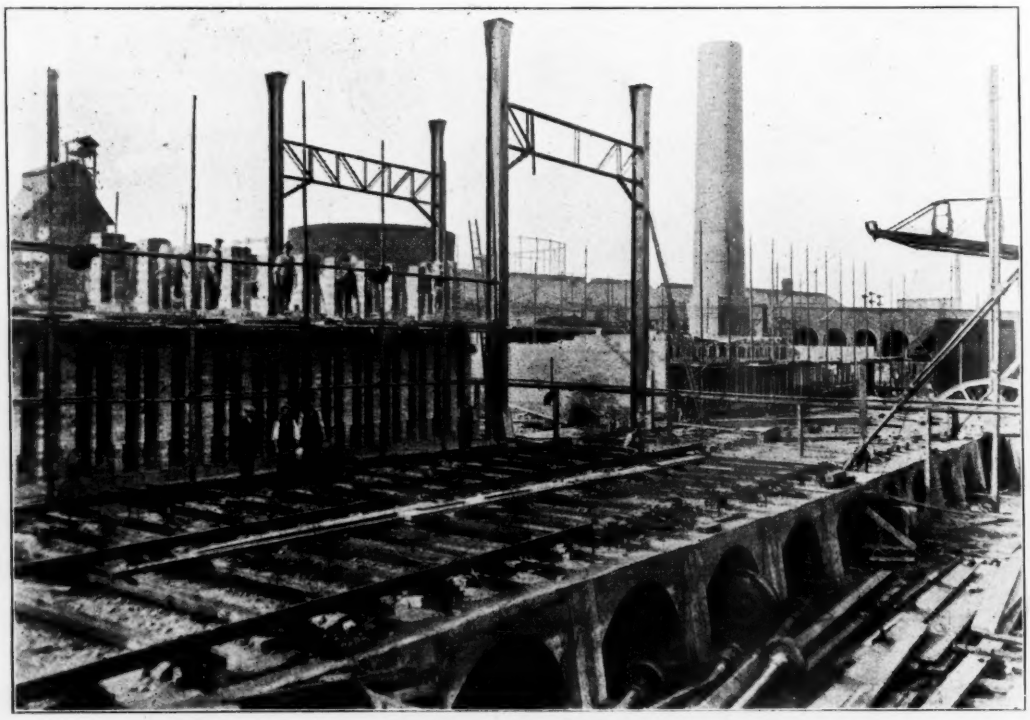
Preliminary Firing.—The fires at this stage should be supplied with more fuel, and the air admission be diminished to the quantity necessary for complete combustion; and one should make sure that clean fires are maintained. The preliminary firing should proceed for a period of ten days, until one is able to discern an appreciable temperature in the vertical heating flues. The aforementioned periods are the most important during the whole of the heating-up process. During the preliminary heating-up (from 200° to 600° C.), the greatest expansion of the chamber brickwork takes place; and it is therefore of the highest importance to pay the greatest attention to the chambers during this period. The tie-bars should be tightly screwed up. Soft wooden washers, about 60 mm. thickness, will have been provided; and these will partially take up the expansion.

Final Heating-Up.—The final heating of the chambers is best effected by means of producer gas—in our case Mond gas is employed. In from four to five days' time, the temperature of the oven brickwork may without risk be increased from 600° to 1000° C. Great care should be taken in the final heating-up by the producer gas, as there are possibilities of explosions taking place.

Before proceeding with the final heating-up by producer gas, the "heating gas" main should be thoroughly blown through, and the final gas be analyzed, and the fact ascertained that no free air is present in the gas-main. Every gas-cock between the regenerators and the gas-main should be closed. One should prove positively that this is the case by examining each plug-cock, and not depend upon the marks on the cocks as to whether they are apparently closed. After this, the change-over gear should be examined, to see that it works correctly and easily; and particular attention must be given to ensure that the air flap-valves are open on the side where the gas is to be admitted, and the waste heat valves in the kneepieces are all properly closed. Further, the two main flue dampers should be examined, and the fact ascertained that the damper on the side where gas is to be admitted closes tightly.

The "biscuit" dampers over each of the vertical flues should be arranged accordingly for the small quantity of gas which is to be admitted at first—that is, they should be open very little (in the middle flues about 20 to 30 mm., and the outsides 60 mm.). Before gas is admitted to each oven-wall, the vertical flues must be examined to ascertain whether the temperature is sufficiently great to ignite the gas. The nostril bricks should show a dull red heat. After the perforated openings for the direct firing have all been thoroughly closed for each oven-wall, the producer gas from the main is slowly turned on to one wall after another (care being taken to open the gas-cocks very slowly), and the ignition of the gas observed through the vertical flues from the top of the chambers. At first, the cocks should not be opened more than 10 per cent. of their area.

When all the walls on one side of the chambers are connected up, the gas may continue to burn for a number of hours, after which each cock on each side may be reversed—the ignition of the gas being again observed. The gas may also, in turn, be allowed to burn for several hours, in order that the opposite regenerators may be well warmed up. The chimney draught should be very little for the first few days, and then increased



VIEW SHOWING EXTENSIONS—FIFTY-FOUR ADDITIONAL OVENS IN COURSE OF CONSTRUCTION—THE COKE SIDE.

gradually together with the admission of producer gas, until, in from four to five days, the vertical flues attain a temperature of 1000° C.

Chamber Regulation.—For uniform heating of the walls, the "biscuit" dampers must be adjusted. From experience, it has been found that the most suitable positions to begin with are: From the centre outwards, 35, 35, 40, 45, 50, 50, 60, 60, 70, 70, 80, 80, 90, 100, 100 mm. The figures represent the distance of the segment from the "biscuit" edge.

In connection with the regulation of the heats, the following points should receive daily attention. In order to obtain a constant draught, the main chimney damper should be so set as to show a depression in a water-gauge of about 20 mm.; and the gauge should be fixed at the juncture of the waste-heat flues to the chimney. At Saltley, a continuous record is obtained by a whipple indicator; and the waste flue temperatures are also automatically recorded by means of a mercury pyrometer. These should not exceed 200° to 250° C. In the same way, the pressure of the producer gas in the mains should be kept constant and recorded. The gas pressure is regulated according to the quality of the producer gas. The following sheet shows how the various tests are recorded daily.

The importance of the recording instruments cannot be overrated. For instance, a very excellent check on oven heating may be obtained by observing the temperature of the waste-heat gases at a point just in front of the chimney damper, which is done, as before stated, with the aid of a recording mercury pyrometer. This temperature should always vary between certain values. Should a sudden fall in the temperature be noted, then some of the air flap-valves on the descending gas side will be found not to have closed, or else the change-over side waste heat dampers do not close tightly. Again, a slowly falling temperature curve over a period of two or three days indicates defective combustion—that is, through an excess of gas or air, or through a low calorific value of the producer gas. A check on the latter may be made by the use of a recording calorimeter, such as is employed at Saltley.

It has not been possible to make a continuous test on the ovens; but as they "work through" on Sundays, and our other work—horizontal and inclined retorts—is closed-down, usually for twelve hours, we are able to get some idea of the results that are being obtained. I have, however, to thank Mr. Chaney for allowing me to extract from his Institution paper the figures which we obtained from a seven days' test.

Daily Sheet for Mond Plant and Coke Ovens.

Generator.															Ovens.								
Temperatures.					Gas Analysis.						Calorific Value. B.Th.U. Net.				Waste Gases.						Temperatures (Deg. C.).			
Hour.	Saturation. ° C.	Outlet Generator. ° C.	Inlet Cooler. ° F.	Outlet Cooler. ° F.	H_2S	CO_2	CO.	CH_4	H_2.	N_2.	Calculated.	Determined Spot Tests.	Recorder.	Pressure in Ovens. mm.	Hour.	No. of Oven.	CO_2.	O.	CO.	CO_2 recdr.	Hour.	Vertical Flues. Gas Side.	Vertical Flues. Waste Side.	Chambers.
9 0 a.m.	68	510	110	82										16									1240°	
10.0 ,,	69	548	110	82								153	155	18									1160	
12.15 p.m.	69	562	120	86								131	137	18	2.45 p.m.	(4-5) R.S.	15·9	1·2	0 0				1160	
2.0 ,,	70	520	140	95										16	3.40 ,,	(5-6) ,,	17 3	0·4	0·0		10·15 a.m.		1200	
3.0 ,,	68	554	140	95	Average sample							Av. from chart		16	4.10 ,,	(6-7) Q.S.	17·0	0·8	0·0				1240	
	69°	539	124	88	0·3	7·1	24·6	3·4	14·9	49·5	155	153		17									1260	No. 5
																							1200	1060°
																							1240	
																							1240	
																							1240	
																							1200	
																							1170	
																							1250	
																							1215	

Coal and Ashes.

Generator.										Ovens.		
Name.	Weight.		Hoppers.			Ashes.				Name.	No. of Trucks.	Percentage Moisture as Stamped.
	T.	C.	M.	A.	N.	M.	A.	N.	Total Barrows			
"A" Coal	10	14	10	10	10	3	3	0	6 Good	"C" Coal	9	—
"B" ,,	3	0										

Coal, 50 Per Cent. South Yorkshire, and 50 Per Cent. Derbyshire.

Charging from top of ovens (unstamped).

Duration of test	7 days
Number of ovens charged	84
Gas made, corrected for temp. and bar. (CO_2 not removed)	8,219,000 cubic feet
Coal carbonized (raw)	650·35 tons
Analysis of coal—	
Water	4·0 per cent.
Ash	4·5 ,, ,,
Gas made per ton of coal, corrected for temp. and bar.	12,640 cubic feet
Illuminating power, No. 1 burner (CO_2 not extracted)	14·05 candles
Illuminating power, No. 2 burner (CO_2 not extracted)	17·00 ,,
Calorific value	500 B.Th.U. net per c. ft.
,, multiple	6340
Specific gravity of gas	0·437

Analysis of Gas.	Per Cent.
Carbonic acid	2·1
Hydrocarbons	2·9
Oxygen	0·7
Carbonic oxide	7·8
Hydrogen	50·0
Methane	30·0
Nitrogen	6·5

[Recent working has shown nitrogen percentage about 4.]

Sulphur in gas, other than H_2S, 30·7 grains per 100 cubic feet.
Cyanides as $Na_4 Fe(CN)_6$ 3·34 lbs. per 10,000 cubic feet.

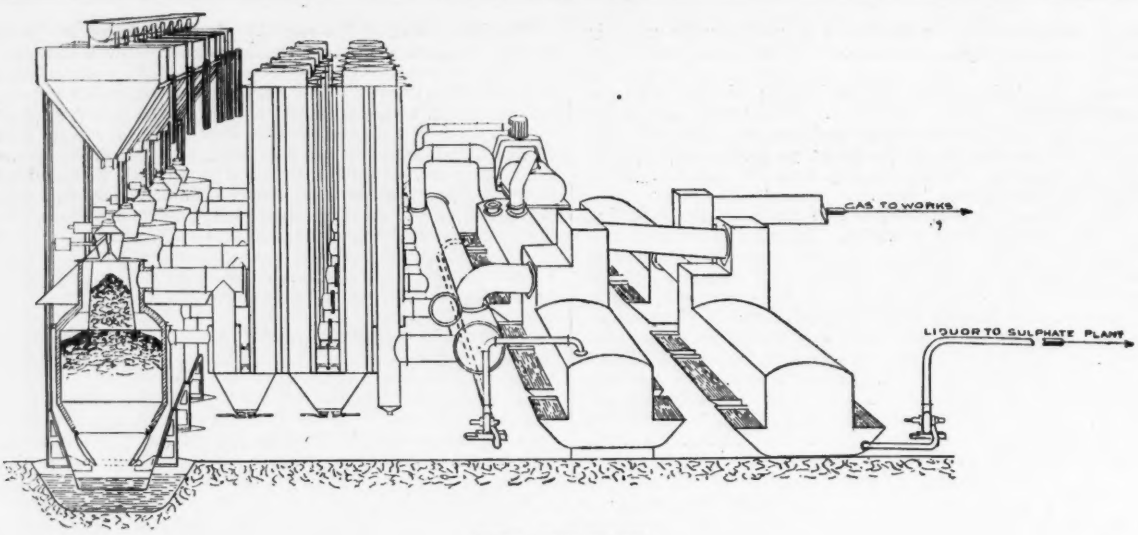
THE MOND GAS PRODUCER.

The manufacture of Mond gas is well known; but since a question was set in the final grade "Gas Engineering" examination this year, I may be pardoned if I briefly describe the manufacture. The information may be found useful to this, a Junior Association, as some of the members have not yet taken the examination, and may not be acquainted with this method of producing cheap power gas.

In the Saltley installation for supplying heating gas to the Koppers chamber-ovens, five producers have been provided, one of which is to act as a stand-by. Each producer is capable of gasifying 18 tons of coal, coal slack, or peas, or a mixture of coke dust, small breeze, and coal slack, per 24 hours. The fuel is fed into an elevator pit direct from the railway waggons, and elevated by means of a bucket elevator and conveyor, to an overhead storage hopper fixed over the five producers, and from which hopper the producers are fed. Each producer is provided with a water-seal, and is so arranged as to allow the ash and small clinker to descend into the water, from which it is periodically removed by shovels fitted with long handles, without in any way interfering with the working of the apparatus.

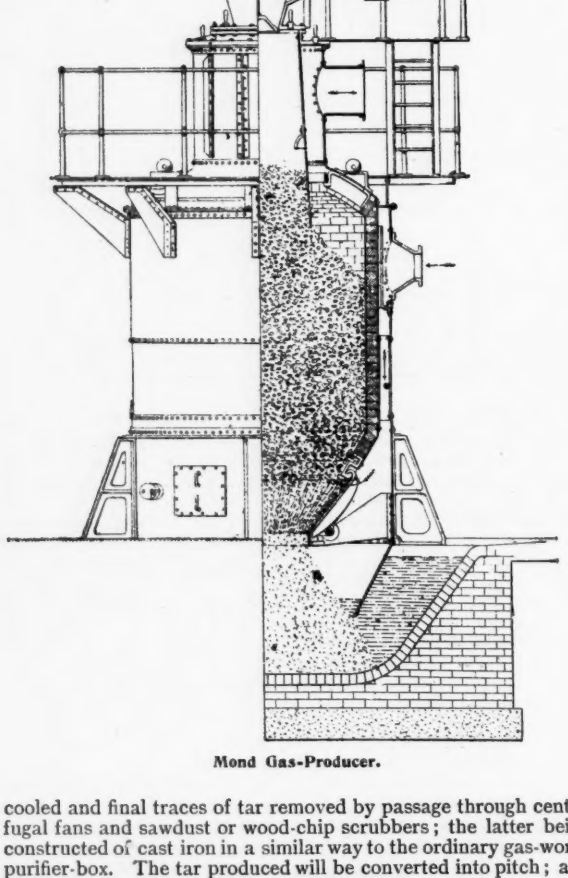
In some installations automatic ash removing devices have been fitted; but these have not been adopted in our case. By means of Roots blowers, a saturated blast of air is continuously passed through the producer, and the process of combustion is carried out at a comparatively low temperature. By this means clinker formation is avoided, provided the fuel does not contain an excess of incombustibles; and the low temperature also provides against the destruction of the ammonia. The quantity of steam required, when working under ammonia recovery conditions, is equal to 2½ tons for every ton of fuel gasified; but when working under non-recovery conditions, ¾ ton of steam will suffice.

From the producers, the gas passes to a superheater, so arranged



MOND GAS PLANT.

that some of the heat of the gas which enters it is given up to the saturated air-blast on its way to the producer, with a consequent cooling of the gas. From this point, the gas is conducted to the mechanical washer—a steel rectangular chamber—in which it is washed by a fine water spray formed by the rapidly revolving paddles or dashers. In this washer, both tar and dust are washed out, and from time to time removed by ladles from the lutes provided in the washer side. From the washer, the gas passes to the absorber, where the ammonia is absorbed by means of sulphuric acid, forming sulphate of ammonia by the "direct" process—fresh acid supplies being added as the sulphate liquor is drawn off. The latter is then evaporated in a vacuum evaporator, and crystals of sulphate of ammonia are formed. Finally, the gas is further



Mond Gas-Producer.

cooled and final traces of tar removed by passage through centrifugal fans and sawdust or wood-chip scrubbers; the latter being constructed of cast iron in a similar way to the ordinary gas-works purifier-box. The tar produced will be converted into pitch; and suitable plant is being installed for this purpose.

The advantages of Mond gas are well known, but perhaps I may be allowed to remind you of a few. It may be produced from the cheapest quality of coal, slack, or dross. The amount of labour required for its production is small; and the gas, when produced in large quantities, costs less than ½d. per 1000 cubic feet. Its heating value is equal to from 75 to 85 per cent. of the total heat energy contained in the fuel used for its production. A ton of good slack coal will produce about 150,000 cubic feet of Mond gas of a calorific value of 130 to 140 B.Th.U. per cubic foot. For large gas-works, the heating of retort-settings may be more economically accomplished by Mond gas than by coke firing; and the wear and tear of the settings should be found to be considerably less. No difficulty has been experienced at Saltley in obtaining regular heats in the chamber-ovens by means of this gas; and I confidently believe its use will be greatly extended in future for the heating of retort-settings, whether horizontals or verticals. Considerable economies are to be effected in the retort-house by the adoption of Mond gas as the heating medium.

MIDLAND JUNIOR GAS ASSOCIATION.

The First General Meeting of the Ninth Session was held last Thursday evening, in the large hall of the Municipal Technical School, Birmingham, when about seventy members were present, and also several visitors, including Messrs. W. Chaney, J. Foster, E. W. Smith, and R. A. Dry. At the outset, the chair was taken by the retiring President (Mr. F. Shewring, of Droitwich).

Mr. SHEWRING said that his own term of office was now ended. The past session had afforded him very much pleasure. They had had good papers and visits, and he thought the session had been a very successful one. He wished to thank the officers and members of Council, and especially the Hon. Secretary (Mr. W. J. Pickering), for all the help they had given him during the session. It was now his pleasant duty to ask Mr. Johns, the new President, to take the chair. He had known Mr. Johns for many years, and heartily congratulated him on his attainment of the position of President of the Association, and also on his appointment as Gas and Electrical Engineer at Malvern.

Mr. W. H. JOHNS (of Saltley), the new President, then took the chair, and at once proposed a hearty vote of thanks to Mr. Shewring for his work as President during the past session. It had, he said, been a most interesting and pleasant year to all. The visit to Droitwich, especially, was most enjoyable, for it always afforded much pleasure to the members to see their Presidents "at home" in their own works. It did not fall to the lot of all to be in sole charge; but in the visits they liked especially to see the work of juniors. He thanked Mr. Shewring for his kind words with reference to his appointment to Malvern. He hardly needed to assure the members that he would be loyal to them and the Association generally, and not "run away."

Mr. F. J. WARD (Knowle), Senior Vice-President, seconded the vote, and remarked that Mr. Shewring had excelled himself, and had left the Association in as high a state as, if not higher than, he found it.

The vote was heartily accorded, and

Mr. SHEWRING, in reply, said all he had done was done willingly; and it would be a source of much pleasure to him if he could be of help to the Association at any time in the future.

The PRESIDENT then delivered his Inaugural Address, which is given on pp. 153-8 of this issue.

At its conclusion,

Mr. WARD said it was his privilege to propose a vote of thanks to the President for his able and instructive address. They had all expected something out of the common, and they had certainly had it. He had been specially interested in the remarks on Brooke's slides. No doubt they were all aware that a somewhat similar device was introduced by Mr. Hudson, of Normanton, in 1901 for the regulation of chimney draught; but the application of such a device to the regulation of primary and secondary air was, of course, entirely new.

Mr. G. C. PEARSON (Birmingham), the Junior Vice-President, seconded the vote, and said no doubt the address would be valuable to all the members. While he did not wish to in any way

criticize it, he would like to make a few remarks. With reference to Brooke's slides, Mr. Brooke, he was quite sure, knew of Mr. Hudson's device for regulation of chimney draught; but it must be obvious that though in both cases a vane was used, yet there was no similarity in construction. Also Hudson's device would be entirely unsuited to the regulation of retort-settings, whereas Brooke's slide was specially designed for this purpose. In addition to the points mentioned in the address in favour of the device, he thought another very important one which should be made lay in the value of its application to vertical settings—speaking particularly of the Dessau and Woodall-Duckham systems, with which he had had experience. The application of Brooke's slides to horizontal settings undoubtedly involved more supervision than ordinary slides usually received; but in the case of verticals, the supervision required was reduced, in addition to the other advantages. To take the instance of the Dessau system, the setting was so delicate that, should the flame from the producer gas injector-nozzles in the combustion chambers be shortened by an increase of producer gas made, damage could be done to the bottoms of the adjacent retorts in a very short time; and the German instructions for control of this setting (ordinary slides) stated that the primary air should be adjusted at least every two hours to show a little blue flame in the waste-gas flue, that this danger might be obviated. Brooke's slides overcame the waste of gas, and a good deal of this supervision. In the case of the Woodall-Duckham system, the preheated primary air was controlled by a cast-iron damper plate under the ashpan, which was set by the somewhat crude method of a chalked rod. This damper required gradually opening during the two or three days between clinkering; and Brooke's slides to this setting were a boon and blessing. With reference to the recording calorimeter, he thought these instruments were most valuable in regulating manufacture. They were a splendid "tell tale" of the work. The question of accuracy of reading to a few B.Th.U. did not strike him as important, as errors were constant, and the slightest variation in calorific value of the stream of gas recorded. The topic of coke-oven or vertical carbonization brought to the mind special considerations somewhat new to the gas industry; and he hoped the Association might hear more on these topics from Saltley later. He referred particularly to such questions as the dealing with the hydraulic main pitch. They were all aware of the fact that gas from coke-ovens and verticals entered the hydraulic mains at a very high temperature, thus causing the pitch which first settled out to be deposited without sufficient lighter tar to make a mobile solution. This pitch had to be dealt with in such a manner as to preserve the pitch, save labour, and maintain the illuminating power of the gas. The usual method was the circulating of lighter tar through the hydraulic mains, thus dissolving the pitch; but a point arose here. Because of the high temperature of the hydraulic main, the fixed ammonia salts, such as chloride, were soluble (the free ammonia being yet at too high a temperature to dissolve); and this fixed ammonia formed a crystallizing solution in the water (5 per cent. or so) of the tar, making the tar difficult to handle, and causing a loss of ammonia, as it was sold as tar. At the same time, this provided a possibility of the separation of the more valuable ammonium chloride from the rest of the ammonia. In conclusion, he would like to say how interesting it was to hear of the use of Mond gas, and to state that there was a possibility of an experimental run this winter with Mond gas heating upon the Dessau and Woodall-Duckham installations at the coal-test works at Birmingham.

Mr. W. CHANEY (Saltley) said it gave him much pleasure to listen to Mr. Johns's address, which contained a great deal of information, covering many months' work. He would like to say a word or two with reference to the application of producer or Mond gas to the heating of retorts. With the present method, there was a large loss of heat; and they were saddled with a fair amount of coke-dust as a bye-product. The Mond producer enabled them to gasify this and lessen the fuel account; while in the recovery plant they were able to recover more of the nitrogen as ammonium sulphate. At Saltley, with the new coke-oven and producer plant, they were hoping to recover 90 lbs. of ammonium sulphate to the ton of fuel.

Mr. J. FOSTER (Windsor Street) said he thought there was much point in Mr. Johns's remarks *re* examinations, and no doubt some change in the direction indicated would be advisable. He had been very interested in Brooke's slides. Mr. Johns spoke of lengthening the period of clinkering from 24 to 48 hours; but they found at Windsor Street they were able to run 72 hours on the beds where the slides were in use.

Mr. E. W. SMITH (Birmingham) had much pleasure in supporting the vote of thanks to Mr. Johns. Mr. Pearson had drawn attention to the amount of supervision required by the Brooke's slides. The device, however, amply paid for itself; and if anyone doubted this, actual experiment would soon convince him of its value. He wished also to congratulate Mr. Johns on the excellent programme arranged for the coming session.

The vote of thanks was cordially passed.

The PRESIDENT briefly replied, and, referring to Mr. Foster's remarks about the period of clinkering, said he thought that at Windsor Street they introduced a little steam under the fire-bars, which, of course, influenced the formation of clinker. But at Saltley they found it more convenient for other reasons to clinker every 48 hours. He hoped the session would prove an interesting and instructive one. They had an excellent series of papers and visits, and he had tried to make it a good carbonizing year.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

Opening of the New Session.

The opening meeting for the session 1913-14 of the Eastern District Division of the Scottish Junior Gas Association was held in the Heriot-Watt College, Edinburgh, on Saturday. There was a large and highly interested attendance; the chair being occupied by Mr. A. BISHOP, of Newtongrange, the outgoing President.

Mr. BISHOP remarked that he was glad to see so large a gathering, which he said spoke well for the future of the Association. He was sorry, however, to say that Mr. W. Geddes, the new President, would not be with them on account of illness. He asked the Hon. Secretary and Treasurer (Mr. Lawrence Farquhar) to read a letter he had received from Mr. Geddes. It was dated the 9th inst., and was as follows:

> Dear Farquhar,—As you know, owing to illness I will be absent from our opening meeting on Saturday, and either you or the Vice-President might be good enough to read my address. Should it be criticized, I will take the first opportunity of replying. I am indeed very sorry I cannot be with you, but I know the affairs of the Association will, in my absence, be carefully looked after by Mr. Chalmers. We are about to commence what I trust will be a very successful session, and, if the members will only come forward, that, in view of the interesting syllabus that has been prepared, should be a foregone conclusion.

Mr. BISHOP (continuing) said the time had now come for him to quit the chair. He took the opportunity of thanking the members for the way in which they had turned out at the various meetings, and also Mr. Farquhar, who, as Secretary, by his hard work had made matters very easy indeed for him. He expressed the hope that Mr. Geddes would soon be restored to health, so that he could assume the duties of President.

The chair was then taken by Mr. R. B. CHALMERS, of North Berwick, the Vice-President. He said they were all sorry Mr. Geddes was not present, and he trusted before the date of the visit to the Blairhall Colliery, which was a long way off (the 25th inst.), he would be out again. Continuing, he went on to say that the first duty he had to perform was to present the medal to the retiring President. As they all knew, at the last meeting it was decided not to spend so much money on the medal, but to take something off the cost and use the amount saved in purchasing a volume to be given to the member who read the best paper at their meetings. Mr. Masterton, the Engineer and Manager of the Edinburgh and Leith Corporations' Gas Commissioners, had written to say he would be very pleased to judge the papers when they were sent to him. Mr. Chalmers then handed the medal to the retiring President, with the remark that he hoped Mr. Bishop would be long spared to wear it.

Mr. BISHOP briefly returned thanks. He remarked that, though he had now left the chair, he should always take an interest in the affairs of the Association.

The VICE-PRESIDENT then read the address prepared by Mr. Geddes, prefacing it with the remark that the members would reserve any discussion on it until the President was better, and able to be present.

PRESIDENTIAL ADDRESS.

After touching briefly on domestic matters, the President proceeded as follows.

A GENERAL SURVEY.

Turning from the somewhat restricted view of parochial affairs to the broad, general outlook, we find the industry to-day occupying a position of eminence it has never hitherto attained. The output of gas for the past year has, in almost every undertaking, eclipsed all previous records; and while the coal strike was, in a measure, responsible for the increased demand, the greater attention now being paid to the publicity department is the real cause of the steady upward rise.

This year—1913—witnesses the centenary of statutory gas supply. One hundred years—an inconsiderable period in the life of such an industry—have passed since George III. granted the Gaslight and Coke Company a Charter to ply their business; and during this time no less than 1620 undertakings, employing 120 millions of capital, with a total annual make of over 210 thousand million cubic feet, and providing the means of life to thousands, have sprung into existence in the United Kingdom alone. Despite the fierce competition by other illuminants, our industry still continues to forge ahead. Concentrated effort is now being applied in a scientific manner to the selling of our commodity; and the work of the British Commercial Gas Association has, I am sure, your sympathy, and, I hope, the practical help of your undertakings.

While the distribution side appears at present to be getting an undue share of "nursing," on the works there is no slackening of interest. Vertical retorts are no longer the idle dreams of a few visionaries. They are practical realities; and they have come to stay. This type of retort is yet but a fledgling; nevertheless its potentialities are far-reaching, if not, indeed, revolutionary. Keen observers and thoughtful minds are at work on the problem; and while the evolution of the perfect retort must, in the nature of things, be gradual, yet during the last few years immeasurable progress has been made. In this connection it is worthy of note

that the Scottish shale retort now seems to be receiving its due meed of praise for pointing the finger directing investigators to the easiest road to travel.

In the realm of purification, all eyes are turned towards Birmingham. Dr. W. B. Davidson, of the Nechells Works of that city, is at present the arch apostle of liquid purification; and his contributions to the Institution and North British meetings deserve careful study at the hands of those who would work along progressive lines. As you are doubtless aware, Dr. Davidson claims to have achieved complete success in extracting the H_2S and CO_2 by means of a purified ammonia solution. Previous experimenters in this direction have been many; but the point which eluded his predecessors, Dr. Davidson has grasped, and turned their defeat into victory. The stumbling-block which former researchers failed to overcome was the great loss of ammonia; but Dr. Davidson, by the introduction of carefully regulated and graduated pressures in the various stills, and a system of temperature controls, has succeeded where others have failed. While we are assured that the cost of complete liquid purification works out at a comparatively low figure per ton of coal carbonized, no data have yet been published; and until definite figures and particulars are forthcoming, the cautious "wait-and-see" policy will be adopted.

Speaking generally, no drastic change in the operations has recently taken place in our Scottish works. We are all, of course, well aware of the advantages gained by the introduction of mechanical scrubbers and washers; but why many managers, in these days of low illuminating power and the consequent disregard of carbonic acid, still persist in the use of lime in the final stages of purification, I cannot understand. Oxide of iron—especially when it is revivified *in situ*—possesses the outstanding features of cheapness and utility; and its general use would, in my opinion, minimize one of the most trying occupations in a gas-works, in addition to reducing the cost per 1000 cubic feet into the holder without in any way impairing the calorific value of the gas. The recent pronouncement of Mr. Charles Carpenter on reducing the sulphur content of the gas by the application of heat has aroused keen interest, especially among our English brethren. The subject has not the same vital importance for us, because of the comparatively small percentage of sulphur contained in Scotch coal as compared with English coal.

Apart from the gas itself, the residuals are the most valuable produce of a works; and managers should be willing and anxious to go to lots of trouble in order to convert them into as many saleable commodities as their circumstances and surroundings allow. Just how far the opportunities presented are taken advantage of, I intend to discuss later; but I want to say here that I see no reason why the coal bill should not, except in very exceptional cases, be met by the sales of the bye-products.

This seems an opportune place to refer briefly to the decision of the Joint Committee of the Lords and Commons regarding the purchase of residuals by other gas undertakings to their mutual advantage. As you will remember, the prohibition clause (known as the chemical clause) was promoted by the Alkali Manufacturers' Association—a powerful and influential body, who were concerned only with the safeguarding of their own profits, and who had absolutely no regard for the interests of the community. It was, however, declared, and rightly declared, that there was no reason why gas undertakings should be placed under any restraining influence, and that the manufacture of, and dealing in, residuals should continue on the same lines as in the past.

SPECIALIZATION.

This is the age of colossal combines and gigantic enterprises. Everywhere the one-man business is being pushed to the wall or swallowed up by the joint-stock company and corporation, and the day of personal proprietorship seems to be drawing to a close. In this great evolution, the jack-of-all-trades, the handyman—the individual with all-round, but no expert, ability—is being relegated to a back seat. He is quite behind the times, and must either "get on" or "get out." There are those who think this a harsh dictum; but its truth there is no denying, and it is useless blinking the stern realities of modern commercial life. The captains of industry have realized that specialization is the mother of proficiency; and in our own calling the authority on one subject has been with us for some time. As a matter of fact, he is but the forerunner of a type which, in the near future, shall devote his attention to a still smaller sphere of activity.

Whether the division of labour to such an extent will be good or otherwise for the "labourers" is "on the knees of the gods;" but he who has lessoned well from the cold truths of every-day life will resolve to master and make his own the one particular branch or process of our trade for which he feels himself best adapted. We are all more or less acquainted with the engineering and chemical departments and their various sub-sections; but there is another department which has been clamouring during recent years for its just share of recognition. I refer to the commercial department.

THE COMMERCIAL DEPARTMENT.

It is now acknowledged on all sides—witness the creation of commercial sections in gas associations and the appointment of purely business men as general managers of large undertakings—that commercial and financial interests are the determining factors of the prosperity or otherwise of our concerns; and I want to say something in a general way about the work of the man whose touchstone is, Will it pay? Those of you—and I know you are in the majority—who are engaged in relatively small works may think that this side of the industry is altogether outside your scope. The gentleman, usually of legal persuasion, who acts as secretary to your company, is in the habit of working out carbonizing and other results from the data you supply; and he not infrequently has the buying of coal and general stores, the selling of residuals, and the last word in connection with any contemplated scheme of extension or improvement. Now, with all possible respect to such an official, I submit that, on account of his technical limitations, he is hardly the person to have these responsibilities thrust upon him.

The man in the small undertaking should fight strenuously to have these all-important matters in his own safe keeping; and, because he is not in a position to obtain expert assistance, but must wrestle with and conquer the obstacles unaided, he will develop greater resourcefulness than is usually found in a works more favourably situated. Not only will he have to mollify our old friend the consumer who has been resident in Coatbridge, and who cannot understand why his gas bills here are so much higher; but he will bring his commercial acumen to bear on the most varied problems—ranging from the buying of coal to the lending of cookers. He will find ample opportunity of exercising his judgment and native caution on at least one item—that which relates to capital expenditure.

CAPITAL EXPENDITURE.

Heavy and injudicious capital outlay is sometimes "the straw which breaks the camel's back." With the debit side of the revenue account steadily increasing, owing to the enhanced price of raw material and the increasing labour charges, not to mention rising rates and taxes, and when costs and results are worked out to three places of decimals, the severity of modern existence must be reflected in the careful manipulation of the capital account. It must not be thought that I am condemning all capital expenditure; that way lies chaos. But I do want to emphasize the absolute necessity—especially in small works where the chance of retrieving an error is limited—of obtaining a reasonable return for money invested. Nothing stands more in the way of cheaper gas being supplied to the community, nor of tangible appreciation of work well done by the manager, than a dead-weight of capital dragging down an undertaking.

There are many ways by which this account may be run up to abnormal proportions, and perhaps the most common are: (1) Exorbitant price paid for the concern at the transfer of an undertaking from a company to a corporation. It is hardly necessary to state that this bad bargaining is specially vexatious. The ratepayers have been led to believe that the millennium—cheap gas and handsome profits—is at hand; and when, under municipal ownership and control, the fair promises fail to materialize, there is likely to be a period of stress and strife. (2) Selling gas at an unduly low price for an extended period, in the vain hope of expenses being reduced. (3) Extensions out of proportion to present and future requirements.

In order that you may fully appreciate the foregoing remarks, I have prepared a table setting forth particulars of eight Scottish towns. A distinguishing letter has been used, to avoid invidious comparisons.

Town.	Debt per 1000 Cubic Feet of Gas Sold.	Capital Charges per 1000 Cubic Feet of Gas Sold	Net Cost into Holder per 1000 Cubic Feet of Gas Sold.	Selling Price per 1000 Cubic Feet of Gas.
	s. d.	d.	d.	s. d.
A	5 2	4·85	9·38	1 11
B	19 10	12·84	8·71	2 10
C	8 9	7·46	9·25	2 0
D	13 9	12·09	10·06	2 9
E	8 0	9·41	10·83	3 0
F	5 9	4·69	7·30	1 10
G	4 1	5·08	10·51	2 4
H	7 7	7·73	4·81	1 6

You will notice that B, whose selling price is 10d. dearer than C, is able to manufacture ½d. cheaper, but owing to an extra burden of 5d. on capital is unable to compare favourably. A, whose cost into the holder is only 0·68d. lower than D, is enabled to sell at 10d. less, largely because of the difference of 7¼d. on capital charges. While the interest and sinking fund charges of H are by no means exceptionally low, yet the consumers are in the happiest position of all. This is accounted for by the highly creditable manner in which the residuals are worked up, and the favourable geographical situation of the town.

I do not intend to labour this topic; but for the sake of showing at a glance how money must be ear-marked for capital charges, below is given a table, the figures of which are purely arbitrary.

Gas Sold Cubic Feet.	Fixed Capital.		Interest on Capital and Sinking Fund Per Annum.	Amount Ear-marked Per 1000 Cub. Ft. of Gas Sold Per Annum.
	Amount.	Per 1000 Cub. Ft. Sold.		
75,000,000	£48,750	13s.	4 % = £1950	6·24d.
100,000,000	£50,000	10s.	5 % = £2500	6·00d.
150,000,000	£112,500	15s.	4½ % = £5062	8·10d.

Concerning Coal.

Turning to the revenue account, the heaviest charge found there is that for coal. The financial importance of this item, and its enormous influence on the success of the working results, warrants some reference in this address. The analysis, comparison, and selection of the most suitable raw material for the particular requirements of the undertaking, are subjects which, each year when tendering time comes round, receive, or ought to receive, most careful consideration at the hands of the manager and his assistants. The conditions under which coal is contracted for are of prime importance; and the form of tender should be drawn up in conjunction with the legal adviser to the undertaking. As I am only concerned to arrive at approximately correct deductions from the data supplied by the laboratory department, I do not consider it necessary to describe the method of carrying out the test. But this I may be permitted to say: All works producing eighty millions and upwards per annum should have a test plant, not only for ascertaining the relative values of different coals at the time of purchase, but also for periodical tests of the selected coals, to see that the quality contracted for is being maintained. Coal contractors, being aware that their supplies will be tested from time to time, guard against the possibility of inferior coal being delivered, as, naturally, they have an eye to future business, and they know that any lowering of the quality will militate against their interests. The manager even of the smallest concern can, by running the selected coal twice through his plant, use his own works as a laboratory. This statement may seem satirical to those of you who are struggling along with inadequate accommodation and with obsolete apparatus. I mean, however, exactly what I say; and if your Board deny you the bare necessities for proper production, then it is your business to reason them into a better frame of mind.

What are the essential points to be kept clearly in view in the consideration and valuation of a coal? There is the price per ton, including carriage; its degree of purity; and, if for storing, its safety from spontaneous combustion and freedom from liability to deteriorate to any appreciable extent. Then there is the value of the products (gas, coke, tar, and ammonia), and the extent to which impurities (sulphuretted hydrogen, carbonic acid, sulphur, &c.) are present in the gas.

There are numberless variations in the method of working out the relative values; and in minute detail probably no two undertakings exactly agree. The crucial point to observe, however, is that the same system is invariably followed. If this be done, slight scientific inaccuracies in testing, and trifling omissions in subsequent operations, are not important. Comparative values are arrived at for a particular works; and that is all that is really wanted.

It may be of interest if I give two or three concrete examples, showing in detail what I consider to be a fairly good method of arriving at a valuation. The figures are hypothetical.

Standard Coal.

Cost, 13s. per Ton.	Illuminating Power, 18 Candles.		
Gas.—10,850 cubic feet at 2s. 10d. per 1000 cubic feet.			£1 10 9
Coke.—12½ cwt. at 14s. per ton	£0 8 7		
Deduct ash: 90 lbs. at 14s. per ton	6¾		
			8 0¼
Ammonia.—29 lbs. S/A at £13 10s. per ton			3 6
Tar.—11 gallons at 2d. per gallon			1 10
Total value of products			£2 4 1¼

Coal A.

Offered at 12s. 6d. per Ton.	Illuminating Power, 19·5 Candles.		
Gas.—10,436 cubic feet at 2s. 10d. per 1000 cubic feet.	£1 9 7		
Add allowance for 1½ candles over 18 standard, ½d. per candle per 1000 cubic feet	7¾		
		£1 10 2¾	
Coke.—11 cwt. at 14s. per ton	7 8½		
Deduct ash: 85 lbs. at 14s. per ton	6¼		
			7 2
Ammonia.—30·75 lbs. S/A at £13 10s. per ton			3 8½
Tar.—13 gallons at 2d. per gallon			2 2
Total value of products			£2 3 3¼

£2 4s. 1½d. : £2 3s. 3¼d. : : 13s. = 12s. 9d. purchase value of coal.

Coal B.

Offered at 13s. 6d. per Ton.	Illuminating Power, 15·75 Candles.		
Gas.—11,150 cubic feet at 2s. 10d. per 1000 cubic feet.	£1 11 7		
Deduct cost of enriching up to 18 candle standard, 2¼ candles at ½d. per candle per 1000 cubic feet	1 0½		
		£1 10 6½	
Coke.—13 cwt. at 14s. per ton	9 1		
Deduct ash: 100 lbs. at 14s. per ton	7½		
			8 5½
Ammonia.—27·5 lbs. S/A at £13 10s. per ton			3 3¾
Tar.—9 gallons at 2d. per gallon			1 6
Total value of products			£2 3 9¾

£2 4s. 1½d. : £2 3s. 9¾d. : : 13s. = 12s. 11d. purchase value of coal.

The foregoing tables are, I think, self-explanatory, and do not, therefore, call for comment.

At first sight, it might be thought that the coal which works out at the lowest figure would be the cheapest; but this is not necessarily the case. There are various factors in the proposition still to be considered. The percentage of moisture, for instance, which has quite a big say in determining the quantity of fuel required in the producers, is important. If the ash in the coke be excessive, then due allowance must be made for an inferior product; and an item often lost sight of in the valuation of a coal is its weight in relation to the annual output. In small undertakings, where practically the same plant and labour are constantly engaged, this may be neglected; but in medium-sized and large gas-works, it ought not to be ignored.

Take, for example, two coals. One gives an average per ton of 11,200 cubic feet, and costs 14s. 6d. per ton; the other gives an average per ton of 9600 cubic feet, and costs 11s. 9d. per ton. The illuminating power is the same in both cases. Supposing the working expenses—unloading, carbonizing, repairs, and maintenance, &c.—run to 6s. per ton on an annual make of 100 millions, let us see how the figures work out.

100,000,000 / 11,200 = 8928 tons required		100,000,000 / 9600 = 10,417 tons required	
8928 tons at 14s. 6d.	£6,472 16 0		
8928 ,, ,, 6s.	2,678 8 0		
			£9,151 4
10,417 tons at 11s. 9d.	£6,119 19 9		
10,417 ,, ,, 6s.	3,125 2 0		
			9,245 1 9
Difference in favour of the coal at higher purchase price			£93 17 9

From the foregoing, it is very evident that the point is worth consideration.

Owing to the introduction of the incandescent burner into the homes of even our poorest consumers, and the consequent reduction in the candle power of the gas, cannel coal in many concerns has passed away with the old order of things. The outcome of this state of affairs has been a tendency to increase in the price of common coal, and a corresponding decrease in the price of cannel; and it might be profitable if a limited percentage of the latter class of coal were again used. Let me illustrate the position thus: Eighteen-candle gas has to be made. It can be done either by using common or splint coal only (average price, say, 14s. 6d. per ton), giving an average of 10,500 cubic feet, or by using 95 per cent. of common and 5 per cent. of cannel (average price of cannel, say, 18s. per ton), giving an average of 10,750 cubic feet. Which pays better?

1 ton at 14s. 6d. . . . . 10,500 c.f., or 16·57d. per 1000 c.f.

19 cwt. at 14s. 6d. = 13s. 9·3d.
5 per cent. cannel.
1 cwt. at 18s. . . = 10·8d.

14s. 8·1d. 10,750 ,, ,, 16·38d. ,,

As 14s. 6·0d. : 14s. 8·1d. : : 10,500 : 10,626

124 extra cubic feet per ton obtained in favour of 5 per cent. mixture.

In view of the above figures, I submit the suggestion.

Before leaving this subject, I wish to sound a warning note of the danger that may arise from forming an opinion solely on the high yield per ton, disregarding the other factors in the case. The consummation to be arrived at is not high carbonizing results, but results which will *pay* best; and to this end we, not infrequently have to depend largely upon the revenue derived from the sale of the residual products.

Residual Products.

Time was when we were gas makers pure and simple, and the bye-products were looked on as so much waste, and, consequently, received scant consideration at our hands. All this, however, is now changed, and the residuals are recognized as having very considerable pecuniary value. Ten years ago the revenue obtained by nine (the total number for which data are available) Scottish towns for their residuals was 8·20d. per 1000 cubic feet of gas sold. To-day, the residuals for these same towns amount to 10·40d. per 1000 cubic feet of gas sold—an increase of 27 per cent. Nor have all the possibilities in this direction been yet exhausted. For instance, the virtues of our principal bye-product, coke, as a household fuel are still largely unknown, owing to our peculiar shyness in advertising our wares. Were we to push this commodity, paying due attention to the selection of coal giving a low percentage of ash in the coke, I am convinced that useful business would be done among residents, and the smoke nuisance in congested areas thereby considerably mitigated.

To many concerns sulphate of ammonia is bringing in a steady and increasing revenue; and there are few works with an output of 10 millions and upwards where the manufacture of this valuable fertilizer would not pay better than selling to a distiller the liquor in its crude state. The necessary plant is simple and comparatively inexpensive; and its manipulation is not beyond the intelligence of the average workman. Investigations show that where the tar is sold separately, the revenue is in many cases greater than where the tar and liquor are sold mixed—proving that the distiller is often paid for taking away the liquor. Anyhow, the crude article can be worked up into sulphate as cheaply in our own works as in the works of the distiller—the saving in railway freight alone often representing respectable profits. Moreover, the finished product can always command market value, whereas,

owing to lack of competition, those who are forced to sell their liquor are entirely in the hands of the distiller, and must needs take what they are offered.

The use of tar on our highways has opened up fallow ground for this product; and it lies with us to convince the authorities that it is absolutely the best article for the purpose. As you know, tar binds the surface of the road, and so improves it in appearance. It also makes it waterproof, and, by resisting the breaking-up tendency caused by the pressure and disturbance of motor-cars, prolongs the life of the road. As a secondary consideration, if we succeeded in getting tar-made roads generally adopted, we should be deserving of the thanks of the community for eliminating the dust nuisance.

While speaking of tar, I may say that I consider a distilling plant a necessity for obtaining the best results. The products of distillation find a readier market at an enhanced price; and with a distilling plant can be obtained the oil used by manufacturers of carbolic acid, and also creosote oil and its salts. I see no valid reason why gas undertakings in adjoining districts should not lay down a common plant for the proper working-up of their residual products, including spent oxide, which should be made to yield up its valuable sulphur by converting it into sulphuric acid by means of a vitriol plant. Theoretically, at any rate, it looks a simple enough matter for small concerns, who cannot go to the expense of installing the necessary apparatus, to act jointly in the erection and equipment of an up-to-date recovery plant; and it seems to me that, under competent management, such an enterprise could not fail to give satisfactory results.

I have already detained you longer than I intended, and have but touched the fringe of a huge subject, for commercial and financial interests directly affect and control the working of every department either connected with manufacture or distribution. While the engineer asks, Will it work? and seeks the aid of the chemist to answer the question, the commercial man asks, Will it pay? And if the answer be in the negative, no matter how beautiful in conception or ingenious in construction, the innovation is cold-shouldered. Out of a multiplicity of topics, I have dealt with but three, and these not exhaustively; nor do I lay claim to the least originality in anything I have said. Had time permitted, I should have liked to touch on many other points—economies in the retort-house, the point at which it pays to instal labour-saving appliances, the relations between employer and employee, and the science of salesmanship, to mention but a few "heads." At some future date I may have an opportunity of extending these remarks.

At the close of the address,

The VICE-PRESIDENT expressed the hope that all those present would take away the address, and study it very carefully, so that they could have the discussion when Mr. Geddes returned.

Mr. THOMAS FOX, of Messrs. James Milne and Son, Limited, then read the following paper on

SAFETY GAS-METERS.

Quite recently there has been invented a meter called the "Safety" meter. This consists of a special apparatus which is fixed on the inlet side of an ordinary gas-meter, and which is arranged to automatically give a predetermined quantity of gas when in action, also another apparatus which is fixed to the outlet of the meter. This latter is really a very special service governor or automatic cut-off, and comes into action when the pressure falls below a certain minimum, as well as governing the flow of gas. I propose to explain briefly what the advantages of this apparatus are, as well as its manner of working.

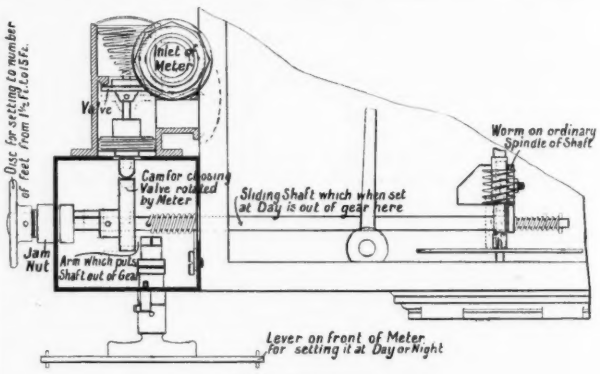
Its chief purpose, and what the apparatus aims at first and foremost, is complete security for gas consumers during the night hours—that is, security during the time when human vigilance is not available. The apparatus, I may say, gives no warning in case of impending danger from gas; but it avoids it automatically, and there is no unnecessary alarming of the family, as is the case with many so-called safety appliances. For the sake of clearness, I shall give you a short description of the working of the apparatus, but without going into very minute details.

On the front of the meter is a lever, which may be placed at "Day" or "Night." If it is placed at the latter, then only a given quantity of gas, which is determined beforehand, and is easily regulated, can pass through the meter; and after this given amount is consumed, then the supply of gas is gently cut off, as in an ordinary prepayment meter. For houses with small bedrooms, this quantity may be varied from 2 to 4 cubic feet; while for houses with larger or more numerous bedrooms, it may be fixed from 7 to 10 cubic feet. Again, when the lever is turned to "Day," the gas is turned on; and in order to avoid the possibility of any danger arising from cocks left open anywhere in the house, the special governor is placed at the exit of the meter. With this governor it is impossible for any quantity of gas to enter the pipes, even when the lever is placed at "Day," so long as any one of the stop-cocks on the premises remains open. But if this cock is closed, the supply is automatically restored. On setting the lever at "Night," therefore, we have at our disposal an amply sufficient supply of gas for different purposes; but should this quantity escape unconsumed, it is too small to cause any danger from gas poisoning, &c. This does not mean, of course, that one should capriciously allow the gas to escape in his bedroom, or the following morning such an experimenter would very possibly have an unpleasant feeling in his head.

It will no doubt be easy to comprehend that with this safety meter, the existence of leakages may be directly detected. The consumer, for example, can satisfy himself every morning that the night supply of gas is completely used up; and from this he will draw his own conclusions, or he will ask the gas authorities for an explanation. The following incident will explain how a "Safety" meter detected the presence of leakages.

In a large office, a 100-light "Safety" meter was placed, because it had again and again happened that when the charwoman visited the premises in the evening the cocks of several appliances, with bye-pass jets, were found open. This was due, of course, to want of attention on the part of someone turning on a burner with an extinguished bye-pass. When the "Safety" meter was fitted (the supply was fixed at 12 feet), it was noticed that the quantity every morning was entirely consumed. After shutting off every lighting-jet, the supply was consumed in ten hours; and however carefully searched for, no leakage could be found in the pipes. Finally, suspicion fell on two gas-stoves; and the leakage was traced to the main stop-cocks of the stoves, which even when closed allowed so much gas to pass through that small blue flames were visible on the stove burners.

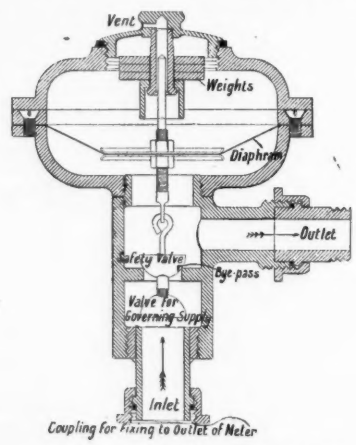
With regard to the construction of the special apparatus fitted to the inlet of the "Safety" meter, to put it briefly this consists of a valve on the gas supply which is worked by means of a cam, mounted on a long spindle, and driven by spur-gearing from the ordinary meter-index spindle. This long spindle is traversed in and out of gear by means of a lever and chains; and, while out of gear, the position of the cam in relation to the valve spindle can be altered so that the meter will, after the cam has been traversed


Inlet of Meter
Valve
Worm on ordinary Spindle of Shaft
Disc for setting to number of feet from 1½ ft. to 15 ft.
Cam for closing Valve rotated by Meter
Sliding Shaft which when set at Day is out of gear here
Jam Nut
Arm which puts Shaft out of Gear
Lever on front of Meter for setting it at Day or Night

Night Apparatus.

into gear again, pass a greater or less quantity of gas before shutting off. It is simplicity itself to set the cam to give the desired quantity of gas. A graduated disc, jam-nut, and pointer are provided on the side of the apparatus; and on slackening this nut the disc can be moved round till the pointer indicates the desired quantity of gas. After this has been done, and the nut tightened up again, the meter is ready for use.

From the illustration it will be seen that the service governor is of very special type. It is applicable either for high or low pressure supplies, and equally useful by itself, as well as when connected to the "Safety" meter. A diaphragm governor is

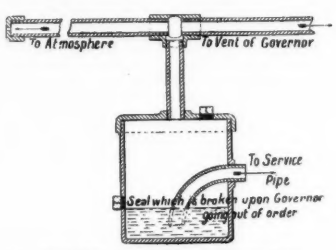


Safety Governor and Automatic Cut-Off.

shown; and, owing to the safety device embodied, there is no fear of trouble, even in the event of the diaphragm bursting. In cases where they are preferred, however, mercury seals are fitted instead of the leather diaphragm.

Now with regard to the construction and working of the governor. You will notice that a double cone valve is used, which, unlike other types, closes the gas-way when the diaphragm is full

up or full down. Another special feature is the way in which the weights are applied; for, as shown, they do not come into action until the diaphragm has risen some distance. The seal-pot—more especially useful as a safeguard where high inlet pressure is obtainable—is connected both to the house service and to the upper side of the diaphragm, or vent hole, of the governor. When the governor is first fixed in a service, either with or without the "Safety" meter, the valve is closed downwards. The gas, being turned on, is at first able to pass the closed upper valve in small quantities only by means of the bye-pass hole shown. When it has filled the service-pipes, however, and if there is no appreciable leakage anywhere, the pressure rises and lifts the unloaded diaphragm. Immediately this happens, the valve opens right up, and the weights over the diaphragm come into action, closing-down the valve-cone when the predetermined pressure is reached. Now, and until the upper valve-cone has once more found its seat, the governor acts like any other—giving a constant outlet pressure, and shutting off dead-tight when the diaphragm rises high enough to seat the lower of the two valve-cones.



Seal-Pot for High-Pressure Gas.

Regarding the seal-pot, this is a most excellent addition to the governor, and the combination should satisfy the most nervous consumer; for supposing that by some mischance the lower cone of the valve refuses to shut off tight, and the pressure in the service-pipes continues to mount, as soon as it got high enough to overcome the mercury seal in the pot it would escape back along the pipe connected to the upper side of the governor diaphragm, and, equalizing the pressures on it, allow the upper valve to drop on its seat, when the governor would remain shut down, and thus drawing attention to the trouble.

The advantages obtained from these special features of governor and seal-pot are, I think, obvious. But to make certain that they are understood, let us suppose one or two occasions when they would be valuable. First, in the event of the gas supply failing momentarily on any occasion, and putting out lights, gas-stoves, &c. Then at night it is sometimes the custom to shut off the gas supply at the meter, and when done (without using the "Safety" meter) this puts out any lights or fires still burning, and again leaves the taps open. In both these cases, when the gas was turned on again, it would find the governor shut down, and only the small quantity which could pass through the bye-pass hole in the upper valve-cone would in this way escape. Lastly, say by accident a fitting was torn down, or a sudden large escape caused in any way, then again the governor would automatically close off the gas supply until such time as the damage was made good or the escape stopped.

At the close of the paper, Mr. Fox explained that he would be glad at any time to lend for demonstrating purposes the meter he had shown.

The lucidity of Mr. Fox's remarks was enhanced by a series of diagrams, in which the workings of the safety device and governor were illustrated, especially, as Mr. Chalmers pointed out, before inviting questions. Mr. Fox had brought before them something that was absolutely new.

A great number of questions were then put to the author. Mr. Chalmers asked about the operation of the apparatus in the event of a house being fitted with pneumatic gas-switches, and having a gas-stove lighted from the bed—the latter as a convenience to save rising and going to the stove in order to get it lighted in the morning, or at any time it might be required from that place. Mr. Fox explained that this matter could be easily overcome, and the fitter would merely arrange for an extra bye-pass for the gas-stove. Mr. Chalmers remarked that it seemed to be a very good safety device; and Mr. Fox reiterated that one great point in connection with it was that people could go to bed in safety.

Questions followed as to the cost of fitting the safety apparatus and the governor; and Mr. Fox said the apparatus would cost from 6s. to 7s., while that of a ¾-inch governor would be from 8s. to 9s.—in other words, the cost would be about the same as an ordinary slot-meter. Replying to the statement that the extra cost would militate against its general use by gas companies, Mr. Fox demurred to this. While he admitted that the meter was one more intended for the consumer than for the gas companies, he pointed out that in one place on the Continent, which he did not specify, there were about 3000 safety meters in use, and that altogether more than 8000 were now in operation, and were still going off. If a meter-rent of (say) 2s. 6d. was paid—and the extra security afforded might well justify this rent—the cost would not be so great as was anticipated.

The thanks of the members were accorded to Mr. Fox for his paper, and some formal business was transacted.

ASPIRATED GAS FOR LIGHTING AND HEATING.

It is well known that the highest flame temperature in incandescent lighting or in heating by gas is obtained by increasing the proportion of air mixed with the gas, so as to make combustion more complete. The system generally in use is to supply the burners with high-pressure gas; but it is attended with certain inconveniences, and moreover necessitates plant for raising the pressure. The Société Aubert Frères have devised a system of employing aspirated instead of high-pressure gas for feeding the burners; and they claim for it the advantage of producing increased lighting power with a reduction of gas consumption. A French patent (No. 453,267 of 1912) has been taken out for the system, applications of which are shown in the accompanying diagrams; fig. 1 being a vertical section of an incandescent burner, and fig. 2 a gas-heating radiator.

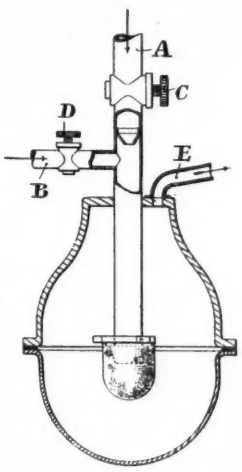


Fig. 1.

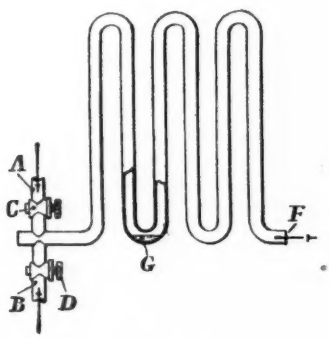


Fig. 2.

In employing the system for incandescent lighting, the burner and mantle, as will be seen, are enclosed in a casing, hermetically closed at the lower part by the globe. The gas intake-pipe A, and that for the supply of air B, are provided respectively with regulators C D, so that a sufficient quantity of air may be obtained for the complete combustion of the gas. The products pass away through the pipe E under the action of suction, or any system other than the natural draught of the burner. To obtain this result, the pipe E can be connected with a suction apparatus, which will draw off the burnt gases. It will be seen that, the burner being supplied with gas through the pipe A, the suction produced in the pipe E will draw in air through the pipe B, and cause gas to flow through the pipe A in quantities suitably proportioned, by adjustment of the regulators, so as to ensure complete combustion, and consequently obtain the maximum lighting power of the burner. By limiting the suction exerted on the burner, this result will be attained with a greatly reduced consumption.

In employing the system for heating, as shown in fig. 2, the radiator can be made of sufficient length to allow the gases to impart all their heat to the surface, since the suction produced at the end F of the radiator ensures the flow of the products. In addition to this advantage, there is that of complete combustion, as in the case of lighting, so that the maximum efficiency of the radiator is ensured, and loss of heat in the discharge of burnt gases obviated. When necessary, a little water can be poured into the radiator at G, for the hot gases to bubble through, so as to localize the liberated heat.

The patentees claim for their system that it possesses the great advantage (especially when used for heating) of not conveying products of combustion into the room in which it is used. Consequently the air is not vitiated, and there is no danger of leakage or asphyxiation. The system is applicable to carburetted air; the oil or other volatile combustible then being directly drawn in by the reduced pressure exerted on the burner.

Vertical Retort Installations in America.—According to the "American Gaslight Journal," the new installation of six benches of vertical retorts of the Dessau type in the works of the Providence (R.I.) Gas Company is now in successful operation. This example, which represents the latest development of this kind of retort, is designed with 15 retorts to the bench, arranged in five rows of three retorts each. Each unit is charged and discharged simultaneously; the lower mouthpiece operating mechanism being actuated by hydraulic power. The foundations of the new retort-house for the Pawtucket (R.I.) Gas Company are completed, and active work on the construction of the retort-benches (which are to be on the Glover-West system) will be started immediately. The expectation is that the benches will be completed early next January. An installation of vertical retorts on the same system is part of a contract obtained by the Didier-March Company, of Perth Amboy (N.J.), for a carbonizing plant of a daily capacity of one million cubic feet, for the Portland (Me.) Gas Company.

AMERICAN GAS INSTITUTE MEETING.

Order of Proceedings.

The Annual Meeting of the American Gas Institute will open to-morrow at Richmond (Va.), under the presidency of Mr. W. R. Addicks, of New York City. A list of the papers, &c., to be submitted to the members was given in the "JOURNAL" for Sept. 30.

The meeting will be preceded by a lecture, to be given to-night by Dr. Lucke, on "Surface Combustion." To-morrow morning, the members will be welcomed by the Mayor of Richmond (Mr. Ainslie), and then the Board of Directors of the Institute will submit their report, which will include reports from Finance, Membership, and Technical Committees and the Secretary (Mr. G. G .Ramsdell). The President will deliver his address, and the Trustees of the Gas Educational Fund will present their report. Reports will then be brought up by other Committees, and a commencement will be made with the papers. This business will occupy members for the morning sitting. In the afternoon, they will have before them reports from other Committees, and four papers. Practically the whole of Thursday will be devoted to papers; the only exception being reports from two Committees. On Friday morning, the joint session with the Illuminating Engineering Society will be held.

MUNICIPAL WATER-WORKS ASSOCIATION.

Second Annual Meeting.

The Second Annual General Meeting of the Association was held in Glasgow last Thursday week, under the presidency of ex-Bailie Archibald Campbell, who has succeeded Mr. E. B. Barnard, J.P., the Chairman of the Metropolitan Water Board, in the office. The new President, who was formerly Convener of the Water Committee of the Glasgow Corporation, in the course of his address, stated that the Association now had 121 members, representing 45 water authorities supplying a population of 16,738,000, with a capital expenditure of £105,500,000. When the Association started a year ago, the membership was 99, representing 37 water authorities supplying a population of 15,665,000 with a capital expenditure of £101,000,000.

The Executive Committee presented a report in which they stated that one important matter they had carefully considered was the proposal to establish a central administrative authority, "empowered to inquire into the whole question of surface and underground water supplies from a comprehensive standpoint, and to serve as an authoritative adviser to Parliament in the consideration of particular schemes." The Committee felt that the Association should cordially support the suggestion contained in paragraph 13 of the report of the Joint Select Committee on the Water Supplies Protection Bill, 1910, that "there is urgent need for a survey, at once comprehensive and in detail, of the water supplies and water needs of the country, and for the adoption of measures for conserving the supply and disposing of it to the best advantage." The report was approved.

Mr. Joseph Parry, M.Inst.C.E., the Chief Water Engineer to the Liverpool Corporation, read a paper on "Standard of Purity for Public Water Supplies;" and Mr. C. G. Henzell, M.Inst.C.E., Water Engineer to the Leeds Corporation, one on "The Growth of Algæ in Leeds Washburn Water, and Incrustation of Mains."

The following are the office-bearers for the current year:

President.—Ex-Bailie Archibald Campbell, of Glasgow.
Vice-President.—Lieut.-Col. Porter, of Liverpool.
Hon. Secretaries.—Messrs. C. G. Henzell (Leeds) and William Terrey (Sheffield).
Hon. Treasurer.—Mr. E. Antony Lees, of Birmingham.
Hon. Solicitor.—Mr. Walter Moon.
Hon. Auditors.—Messrs. R. Hamilton and C. Arthur.

In the afternoon, the members were entertained at luncheon in the City Chambers—Lord Provost Stevenson in the chair. Next day, they visited the Corporation water-works at Loch Katrine.

Underpinning a Retort-Bench at Falkirk.

Referring to the proceedings at the opening meeting of the Western District Division of the Scottish Junior Gas Association, on the 4th inst., our Scotch correspondent says: "The President (Mr. John Wilson, of Falkirk) was very fortunate in having in his presidential year such an interesting and unusual experience as the underpinning of the retort-bench at his gas-works to make the subject of his address. That such a job should have been necessary, shows how very essential it is that engineers should have borings made, and know exactly the nature of the subsoil on which buildings are to be erected. Mr. Wilson's description of the work was very complete; and the interest was greatly increased by the supplementary remarks of his chief, Mr. William Wilson, whose blackboard sketches of the method they adopted for excavating the new foundations were most instructive. His humorous description of the difficulties attending the manufacture of gas with a subsiding bench were much appreciated. It was satisfactory to learn that the work has had the anticipated result, and that the bench is now on a firm foundation. The officials concerned are also to be complimented on the fact that the actual cost was less than the estimate by about £400.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Low-Temperature Carbonization.

SIR,—Referring to your article in the issue of the "JOURNAL" for Oct. 7, I am afraid that the equanimity of the editorial mind has been somewhat knocked off its usual urbane and impartial balance, and has (perhaps inadvertently) distorted what I said in my lecture, and what I intended to convey, which was that, in a *rapprochement* between the two great gas and electrical industries, low temperature carbonization *might possibly* assist the matter.

I find I am not alone in this view; for, on referring to the address of Mr. C. E. C. Shawfield at the meeting of the Incorporated Municipal Electrical Association, he stated "that electricity had won for itself an unassailable position as regards public and private lighting, and that it is making a strong attack upon the position of gas heating."

He thinks, however, that competition should now give place to co-operation with the gas companies.

His proposal is that the suppliers of gas should devote their energies to the economical supply of fuel gas, which could be used for the purposes of electricity.

This is precisely the scheme I endeavoured to predict in the lecture, and to indicate the way in which it might be effected.

Sir, you may be amazed or you may be amused at my lecture, which is quite indifferent to me; but I think the silly ostrich which stuck its head in the sand was more amazed than amused when it found the lasso around its leg.

F. D. MARSHALL.

19, *Queen Anne's Chambers, S.W.*,
Oct. 12, 1913.

[The further contribution of Mr. Marshall accentuates our conviction that he has somewhat and somehow got out of joint with the doings of the gas industry. We now suggest that he should read Mr. Goulden's address to the Eastern Counties Gas Managers' Association as published this week, and repeat the recommendation that he should pay a long visit to the National Gas Exhibition, as well as to the stand of the South Metropolitan Gas Company at the Ideal Home Exhibition. We are afraid that there can be no satisfactory commercial co-operation between the electrical and gas industries—seeing that, commercially, their interests are diametrically opposed. The fact that Mr. Marshall, Mr. Shawfield, or any other gentleman, says a thing is no assurance as to its accuracy. We have examined the affairs of the gas industry very minutely in the light of what the electrical industry is doing; and we fail to find in the business progress of the former any sign of a lasso about its leg, or rather legs, as it has long since been tranformed from a mono-legged industry into a centiped one. Therein is its remarkable safety from all such dire calamity as the myopic picture in their minds.—ED. J.G.L.]

Alliance and Dublin Consumers' Gas Company.

SIR,—It is always a pity when lookers-on join in the fray without following, from the commencement, the thread of the point. In Mr. Houghton we have a gentleman desirous of explaining, on the Dublin Company's behalf, figures which certainly do not appear as clear as they ought in the printed accounts.

In my letter of the 1st of April last, I drew attention to many points, among them that mentioned by Mr. Houghton. Except the typing error of a figure, pointed out by your correspondent, I adhere to my point, which originally was: In the accounts for the half year ended Dec. 31, 1911, it is stated in the revenue account as follows:

Dec. 31, 1911.	
By sale of gas, &c.—	
Gas from 3s. 4d. to 4s. 6d. per 1000 cubic feet— 747,708,350	£87,618 16 10
CORRESPONDING PERIOD, 1912.	
Dec. 31, 1912.	
By sale of gas, &c.—	
Gas from 3s. 4d. to 4s. 6d. per 1000 cubic feet . .	84,469 19 7
Gross difference	£3,148 17 3
As public lighting only is added to these figures, and the total of the two then carried out, I credited the net increase of £365 0s. 11d., bringing down the difference to	2,783 16 4

Now my object was to point out the inconsistency in building-up the accounts, as it will be observed that in 1911 opposite the revenue of £87,618 16s. 10d. appears the quantity of gas sold—viz., 747,708,350 cubic feet, while opposite corresponding figures of the December half year 1912 no quantity of gas so sold is given. But as the 1911 figures in question represent the total gas accounted for, the conclusion is that the figures would be 757,285,000 cubic feet. Therefore, crediting the saving of 1,528,000 cubic feet on works, the net increase is 11,105,000 cubic feet.

In the accounts of leading companies the practice is to show the sale of gas by meters in one item (as one would presume was the case above referred to), and the revenue from *coin* meters as the *difference only* received *above* the current rate to ordinary consumers and that charged through prepayment meters.

The conclusion therefore is that Dublin accounts in December, 1911, showed a sale of 747,708,350 cubic feet opposite a revenue of £87,618 16s. 10d. This is undoubtedly wrong, as I said in my letter in April, as, in comparison, the December, 1912, accounts show a loss of revenue with a higher quantity of gas accounted for. If the facts are different, then the accounts are not explicit, and in future should be amended to

comply with Schedule B of the Gas-Works Clauses Act of 1871 and to state clearly—

1.—The actual net sales of gas at 3s. 4d. to 4s. 6d., opposite the actual charged revenue.

2.—The estimated sales of gas for public lighting and under contracts, opposite the actual charged revenue.

3.—Rental of meters: (*a*) Ordinary, (*b*) Coin—including fittings and stoves.

With this arrangement, no confusion would arise when stockholders endeavour to compare the accounts, one half year with another.

I advise Mr. Houghton to join the band of critics, which I am delighted to say is growing, judging from the letters you have sent on to me, and voice his disapproval of the unsatisfactory state of affairs of this Company.

NONULUS.

Oct. 9, 1913.

P.S.—I am delaying further technical criticism until I see what effect Mr. Dickens's movement will have. One thing I hear: That the old excuse of sale of gas per mile of main is again presented. This I will deal with in a subsequent communication to you.

Obtaining Orders by Misleading Statements.

SIR,—Some time in July last, a representative of a Paris Steel Company called at these works, in my absence, and, by false and misleading statements, obtained an order from my foreman for a sample of tool steel. Instead of a sample, the quantity delivered was about 4 cwt., and the charge for same amounted to over £29.

Will you kindly ask any of your readers who have had similar experiences to communicate with me at once? as I consider this method of doing business should be exposed, in order to save other ompanies from being victimized in the same manner.

Gas-Works, Hythe, Oct. 7, 1913. C. B. TULLY.

[Our correspondent's experience seems to indicate that there is a revival of the somewhat similar trouble which was dealt with in the editorial columns of the "JOURNAL" for July 25, 1911 (p. 221), as well as in a letter from Mr. Harold W. Woodall, of Bournemouth, the substance of which was inserted in the "JOURNAL" for Feb. 27, 1912 (p. 599).—ED. J.G.L.]

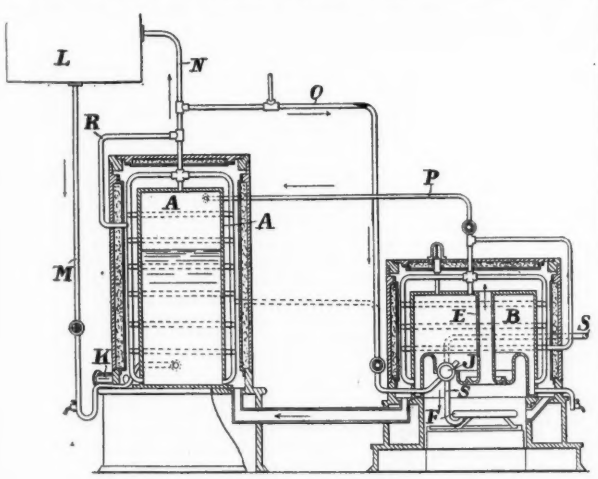
REGISTER OF PATENTS.

Water-Heating Apparatus.

JOHNSON, E. H., of Southborough, Kent.

No. 19,382; Aug. 24, 1912.

In carrying this invention into effect, the hot-water cylinder or container A and the boiler B are each surrounded with a jacket of thin metallic casings enclosing wool, slag, paper, silicate of cotton, or the like. The boiler is furnished with a central flue E leading from the burner F to a chamber between the jacket and the boiler. Thence the flue extends to a similar chamber around the container A. In addition,



Johnson's Gas Water-Heater.

a series of hot-water pipes are arranged in the chambers deriving their hot-water supply direct from the boiler and cylinder. Thus, when a predetermined heat is attained in the boiler and the burner heat is automatically reduced by thermostatic means (diagrammatically represented by J), the water heat is conserved for a long time, particularly by reason of the enveloping heat chambers and the water-pipes in them.

An outlet flue K leads from space around the cylinder A; but at times "the heat of the gases is thoroughly absorbed in the system before the gases are finally exhausted."

Great efficiency is said to be obtained by reason of the fact that the water to feed the boilers is partially heated in the passage from the cold-water supply cistern L. Shortly after the apparatus has been started, everywhere in the system the water is claimed to be boiling or at a good heat—even the boiler supply may be at a temperature of about 130° Fahr. This results from the mode of circulation. Cold water is first fed into the cylinder A from the supply cistern by the pipe M. This exhausts from the upper part of the cylinder by the pipe N. A branch O from the exhaust (or alternatively, as indicated by dotted lines, direct from container) feeds, through the thermostat J, the boiler B. From the boiler pipes P lead back to the container, after a series of convolutions of any desired configuration. Suitable convolutions of pipes leading from, and returning to, the container A are disposed in the chamber, and to further assist circulation, branches R may be furnished. The supply O to the boiler controls, by the thermostat J, the gas supply S—the latter also passing through the thermostat "all in the known manner."

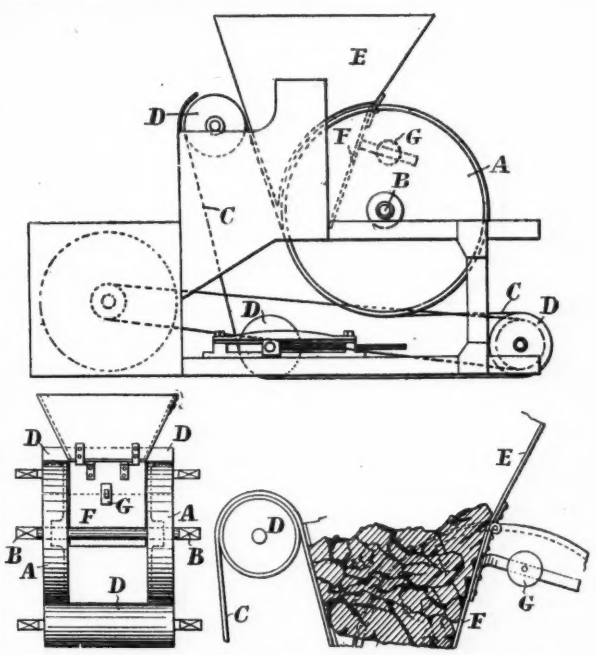
Projectors for Coal-Charging Apparatus.

WILLIAMS, R. A., and W. J. JENKINS AND CO., LIMITED, of Retford.

No. 20,938; Sept. 13, 1912.

The object of this invention is to provide means whereby coal of large size "may be successfully thrown into retorts from charging machines of the projector type," by the use of two separate drums or pulleys mounted a distance apart, with a guide plate arranged between them so as to regulate the feed aperture through which the material that is being dealt with may pass on to the projector band or apron. The guide plate is hinged and kept in place by a weight or spring, so that, when large lumps of the material pass through, the plate may automatically give way—reducing the feed aperture again to its normal size after the lump has passed.

The side view shows the whole apparatus; and there is also a front view and a larger detail of the hinged plate, showing the lumps of material passing between it and the belt.



Williams and Jenkins' Coal Projector for Charging Machines.

A are the separate pulleys or drums mounted on the main shaft B and below which the projector belt C passes on the three guide pulleys D. The material is fed into a hopper E to which the regulating plate F is hinged—being provided with a weight G for bringing it to its normal position after the passage of the large lumps.

Retort-House Governors.

WILSON, J., and PARKINSON AND W. & B. COWAN, LIMITED, of Fitzalan Street, Kennington Road, S.E.

No. 22,335; Oct. 1, 1912.

The patentees say it has been found in practice that difficulties arise due to the usual form of governor employed in connection with retorts, owing to the deposition of tarry matters—in some instances—due to the restricted passage for the gas by way of the slots in the governor cylinder valve. The object of the present invention is "to provide an improved valve, free of these disadvantages, and one which has other advantages as regards ease and reliability of action."

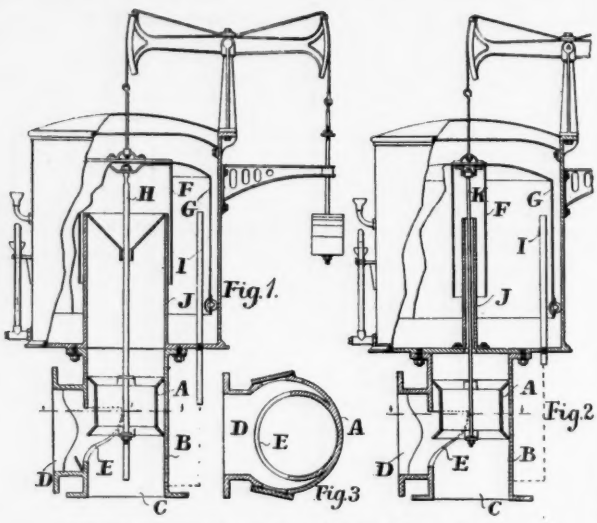
In carrying the invention into effect as illustrated in figs. 1 and 3 (p. 166), the retort-house governor is constructed of a shell A, externally shaped as a cotton-reel—that is to say, with a middle cylindrical part, and two flanges or bevelled continuations. This valve is then disposed in a main B; the inlet C preferably being in a direct line with the valve, and the outlet D at right angles to it. At the part where the outlet joins the main a preferably graduated slot is formed, the opening of which or connection to the inlet is governed by the movement of the valve. The valve need not form a direct seat on the main, but can substantially touch it at both the top and bottom edges.

The main B is continued into a chamber F within a water-sealed bell G; and to the bell at the top there is attached a perforated pipe H projecting downwards through the main and through the valve, being held in it (say) by means of a spider and nuts, so that the inner chamber of the bell is always subject to the pressure of the gas inlet. The interior of the bell is also subject to inlet pressure through the pipe I.

In operation, as the bell is moved by changing pressure of the gas,

due, for instance, to different amounts of gas consumption, the valve A is operated - the connection between the inner chamber F and the inlet C preventing irregular motion of the valve due to possible suction of the outflowing gas drawing gas through the valve and along the top edge of it. The reduced diameter at the middle of the valve enables gas freely to play round it, and prevents the valve being drawn towards the outlet owing to the pressure of the gas.

A rod K (fig. 2) may be substituted for the tube H, and the extension J, instead of being the same width as the main B, is formed of a tube of much smaller diameter. This also enables the diameter of the chamber F to be reduced.



Wilson's (Parkinson and Cowan) Retort-House Governor.

In both forms of the invention the patentees claim that (1) the foul gas has a direct passage from the inlet to the outlet of the governor without having to pass through a cylindrical valve; (2) there is only one regulating opening, and consequently no frictional condensation or deposition of tarry matters due to splitting-up of the foul gases can take place; (3) the graduated opening and the open-ended moving "reel" ensure perfect regulation—the specially constructed reel preventing the varying changes of "make" and "exhaust" disturbing the perfect equilibrium of the governor.

Pyrophorous Gas Lighting Apparatus.

HALPERN, A., and POSPISCHIL, E., of Vienna.

No. 25,557; Nov. 7, 1912. Convention date, Nov. 8, 1911.

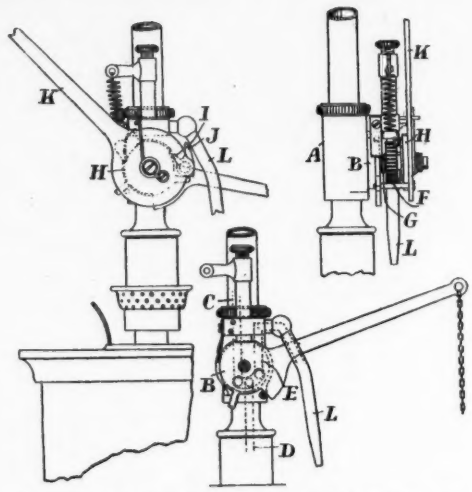
Pyrophorous lighting apparatus for gas-burners are, the patentees remark, known in which, after having effected the ignition, the operating member (which takes the form of a lever and simultaneously serves for igniting as well as for controlling the supply of gas) is automatically returned by a spring into an intermediate position, in which the auxiliary gas-supply conduit is closed. But igniting appliances of this kind have the drawback that, for the purpose of repeating the igniting operation, the operating lever has to be returned into its initial position by pulling a second chain. "This is very inconvenient and liable to cause accidents in so far as, in the event of the ignition failing to act, it may be omitted to close the gas-supply conduit—thus allowing the gas to discharge, with the result that explosions or poisoning may take place."

According to the present invention, this drawback is overcome in that the operating member is, after each operation, returned by a spring into such a position that ignition operations can be repeated one after another as often as desired, by actuating the same member. In order to avoid the complete closing of the gas conduit after an ignition has been effected, the actuating member is so connected with the gas-controlling means that, on a rearward movement of it the gas supply is only partially cut off—*i.e.*, only the ignition burner for the auxiliary conduit is closed. This is so effected that the operating member is connected with the gas-valve by means of a member which engages a recess in the valve, the dimension of which is correspondingly larger as compared with the width of the member.

The illustration shows elevations of apparatus constructed according to the present invention at right angles to each other; also the construction of the rotary slide valve after the removal of the parts situated in front of it.

The apparatus (inserted between the gas-supply pipe and the lamp) consists of a body A on which is arranged the seat for a rotary slide valve B. The gas-supply hole C, the lamp supply hole D, and the igniting hole E open side by side into a seat, and can be connected to one another through an elongated slot of the rotary valve. The valve B is furnished with an operating arm, to the free end of which is attached a chain. A friction wheel F, provided with a ratchet wheel, is mounted loose on the axle of the rotary slide valve; and above it is arranged a sleeve containing the igniting pin. Between the slide and the friction wheel is a coiled spring G for pressing the slide valve upon its seat.

In front of the ratchet wheel a loose disc H is fixed on the axle. It carries a pawl which is pressed resiliently against the rachet wheel. The disc is kept in its position of rest by a spring; the position being determined by the extension of the disc around a stop pin provided on the body A. In front of the disc an operating lever is mounted on the axle. The pawl I, which serves for coupling the lever to the loose disc, is directed towards one tooth of the latter, and is so arranged that, when the lever is rocked, its arm J will stroke the stop pin and release the disc. The disc has also another extension, against which the operating lever K bears in its position of rest with the pawls I J, so that the lever in its position of rest bears also against the pin through the medium of the loose disc H.



Halpern and Pospischil's Pyrophorous Lighting Device.

When the gas supply has been shut off, the slide valve B bears with its extension against the pin of the lever K. When the lamp is to be lighted, the lever is moved down by pulling the chain attached to it, and the slide valve is moved with it by means of the pin bearing against the extension. The lowest position of the lever is determined by the stop pin. In this position, all three holes C D E are connected with each other, so that gas issues from the igniting tube L. At the same time, by moving the pawl I against the stop, the disc H is released, flies back under the action of the spring, and moves the friction wheel F along with it. The spark emanating therefrom ignites the gas issuing from the tube L, and the resulting flame ignites the gas issuing from the lamp. The lever K is then released, so that it is rocked back into its position of rest by the action of the spring.

Gas-Pressure Regulators.

APPARATE-VERTRIEBS G.M.B.H., of Berlin.

No. 4843; Feb. 25, 1913. Convention date, Feb. 28, 1912.

Gas-pressure regulators which are capable of variable adjustment dependent on the consumption which takes place at any given moment in the mains behind the regulator are, the patentees remark, well known. If the consumption in the mains increases, the valves of the regulators fall; and "the falling of the valves causes an additional load on the regulator, which load increases in accordance with the further falling of the valves."

The present invention consists in controlling this additional load by other means, as well as by the consumption, so as to obtain a regular heating effect of the gas. These include the calorific value of the gas upon which the temperature produced in a flame depends. If, for instance, the heating burner of a boiler is considered, it will be seen that, as regards the temperature of the flame, the temperature is influenced by the pressure of the gas in the mains, by the calorific value of the gas, and by the draught of the chimney or artificial draught installation. All these phenomena have an influence on the heat of the flame under consideration. By the use of a pyrometer, the adjustment of the regulator can be directly effected, if need be, by the degree of heat in the flame of the gases, air, or the like.

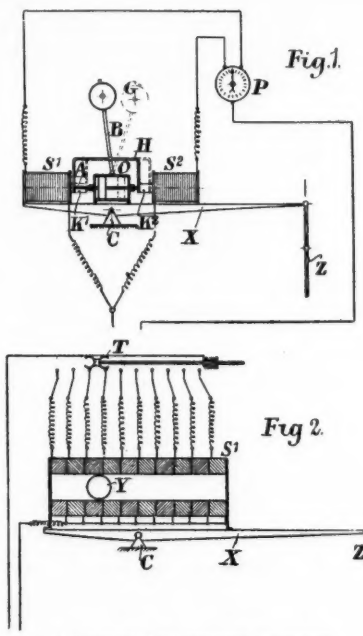
According to this invention, the gas pressure is controlled electrically (or mechanically) in such a manner that the conditions named are taken into account in securing a uniform heat; and consequently it is necessary so to control the burner that, when the calorific value rises (or falls), or is altered by the draught, it will respond to such variations. The installation utilizing gas is not limited to a boiler, as it may just as well consist of metallurgical furnaces, coke-oven sets, or the like; the essential feature being that when one of the means already named rises (or falls) a switching device is set in motion which effects the raising (or lowering) of the regulator.

The invention is not limited to the controlling of the regulator as shown in the accompanying diagrams, which merely illustrate a few arrangements in accordance with the invention. For instance, when it is desired to measure the heating effect of the flame by means of a pyrometer built in the heating device, the pyrometer is caused to close an electric circuit which alters the load on the regulator according as a certain degree of heat is attained, or exceeded. So long as the circuit is closed, the regulator is subjected to a variable pressure till the desired degree of heat is obtained by passing more (or less) gas.

This is effected as shown in fig. 1, by connecting the regulator with a lever X (fulcrumed at C), which carries two solenoids S^1 S^2. These solenoids have two iron cores K^1 and K^2, which are connected by a rod A and a bridgepiece H, to which is connected a lever B, on which is a weight G. On the rod is secured a piston O acting as an air or oil dash pot, so as to cause a restrained motion when the solenoids produce a sudden attraction. The circuit of the solenoids is controlled by the galvanometer or pyrometer P. The lever X is connected to the spindle Z of the regulator.

The mode of operation is as follows: If the heating effect of the flame be lowered, the pointer of the pyrometer is deflected and the circuit of the solenoid S^1 (for example) will be closed, so that the core

is drawn into the solenoid. This, however, can only take place slowly, as the braking action of the piston O has to be overcome. As the core K^1 is being moved, the bridgepiece H must move with its weight G; and, consequently, the centre of gravity of the whole arrangement is displaced—the attraction of the core K^1 causing a release of load as the centre of gravity moves towards the side at which the solenoid S^1 is situated. The gas regulator is therefore unloaded; and less gas is supplied to the flame as the pressure falls. By this means, the heating effect is lessened and the pointer of the pyrometer returns to the middle position, whereby the excitation of the solenoid S^1 is interrupted. The regulator will then continue to operate under conditions of reduced pressure, supplying the gas at a lower pressure to the flame until the heating effect varies, and the pointer of the pyrometer is again deflected.



A German Gas-Pressure Regulator.

Fig. 2 shows a relieving device with several solenoids, in which moves a ball Y. The lever X is itself connected with the spindle Z of the regulator; the fulcrum of the lever being at C. The leads to the various solenoids can be supplied with current through the contacts at the top. The contacting device is controlled by the calorimeter or pyrometer through lever gear.

The operation of this form of device is as follows: According to the value shown by the calorimeter, the contacting device T shifts and closes certain of the contacts. The coils S corresponding thereto will be energized, and the ball (of iron with a corresponding filling mass) is drawn through the corresponding solenoid and assumes a position corresponding to the energizing of the coils. In this way the adjustment of the regulator is altered; and by the alteration of the regulator more (or less) gas will be supplied to the flame, so that in a unit of time the quantity multiplied by the number of calories per cubic metre remains constant.

Experience, it is said, shows in what proportion a variation of the load on the regulator is to take place, so as to maintain the same temperature in the flame in accordance with the variation of the calorific effect; and care should be taken that the valves of the regulator are so constructed that an adjustment adapted to the required amounts passing through for producing a constant temperature can be effected.

Valves Controlled from a Distance for Pressure-Gas or Pressure-Air Lamps.

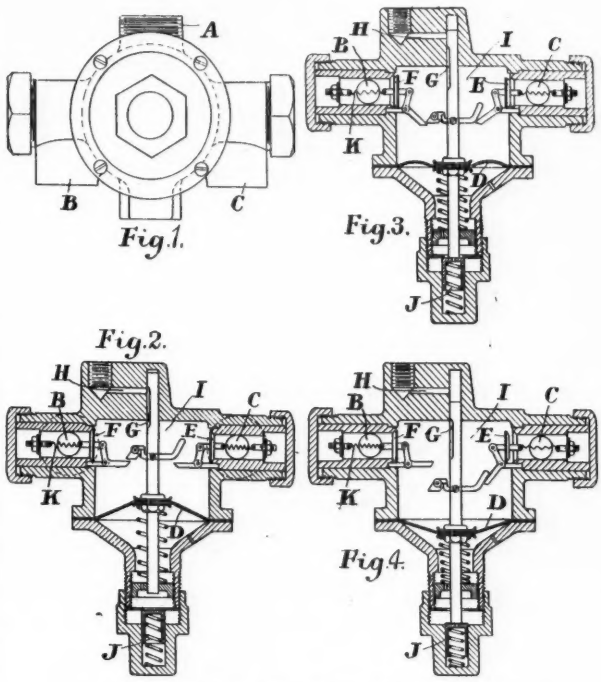
Deutsche Gasglühlicht Aktiengesellschaft (Auergesellschaft), of Berlin.

No. 5124; Feb. 28, 1913. Convention date, June 13, 1912.

This invention relates to valves controlled from a distance—more especially for pressure-gas or pressure-air lamps, wherein the flames controlled by the valve are adapted to be lit or extinguished by a pressure wave or by a temporary increase of pressure above the normal pressure required for operating the lamps. The operation of the valve controlling the supply passage to the flame or flames to be extinguished is effected by a single two-part movement in the same direction of a rod actuated by a membrane or diaphragm. This is accomplished by providing, upon a rod moved by the diaphragm, a projecting part which, during the first part of the movement of the rod, opens the valve, and which, during the further movement of the rod in the same direction, uncouples the valve, which is thereupon closed by spring pressure.

Figs. 1 to 4 show a distance valve applicable to pressure gas-lamps; fig. 1 being a view showing the valve in the position in which it is used upon the lamp, and figs. 2 to 4 illustrating various positions of the diaphragm and operating members.

The gas enters the casing of the distance valve through the connection piece A, and passes through two connection pieces B, C to the lamps or flames. The piece C is connected to the flame, which is to be kept alight permanently so long as there is a certain gas pressure in the pipe. The connection piece B is connected to another flame which it so be extinguished by a pressure wave—that is, a temporary increase



A Pressure-Gas Controlled Valve for Public Lighting.

of the pressure over the normal gas pressure. Fig. 2 shows the operating mechanism in the position of rest; fig. 3 shows the operating mechanism at normal gas pressure; and fig. 4 shows the mechanism when the pressure wave or the increase of pressure occurs.

The membrane or diaphragm D is connected to a rod, and is loaded by a spring arranged on the side of the rod removed from the gas chamber. At low gas pressure, the valves E F are closed, so that gas cannot pass to the two discharge passages of the connection pieces leading to the lamps or flames. The low-pressure gas may, however, pass to the pilot flame through a groove G formed in the rod and a port.

When gas pressure is established in the pipes, the pressure gas passes through the connection A into the gas chamber, and moves the diaphragm as shown in fig. 3, until the tension of the spring balances the gas pressure acting upon it, and the rear extension of the rod J strikes the auxiliary spring. By the movement of the membrane a projection fixed to the rod has been moved against the free ends of elbow levers, whereby the valves F G have been raised from their seats, so as to allow gas to pass through the connections B C to the respective burners, where the gas is ignited by the pilot flame fed through the port, which is so arranged that it is closed by the movement of the rod only after the flames have been lit.

If a pressure wave is now sent into the pipes, the membrane D is moved further in the same direction, until the combined tension of the springs balances the increased gas pressure (fig. 4). In this position the left portion of one of the projections no longer engages the free arm of the elbow lever of the valve F, and the valve has consequently been closed under the action of the spring K, while the valve E has remained in the open position, owing to the fact that the right-hand portion of the projection is so shaped that it does not slide off the free arm of the elbow lever, but retains the lever in a position corresponding to the open position of the valve. When the pressure wave disappears—that is, when the normal working pressure is re-established—the membrane D returns to its prior position; but the valve F remains closed, since the free arm of the elbow lever is not actuated by the projection, and the valve E remains in the open position. Therefore only the flame connected to the passage C will remain alight. If the gas pressure in the pipes falls below the normal working pressure, the valve E will also be closed, and the diaphragm and all the other parts will resume the initial position shown in fig. 2.

Another series of illustrations given in the specification represents a construction suitable for distance valves for pressure-air burners—that is, burners which are supplied with gas under ordinary pressure, while part of the air required for the combustion is supplied under pressure.

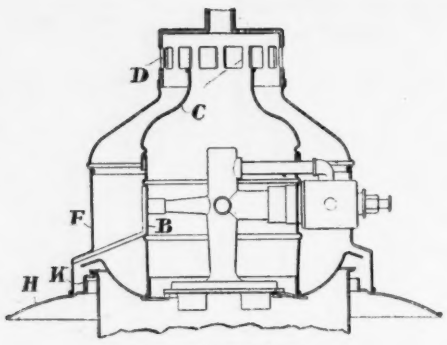
Gas-Lamps.

Anderson, D., of Farringdon Road, E.C.

No. 3010; Feb. 5, 1913.

This invention consists in the construction of a lamp in which the reflector is divided into two parts, one inside, the other outside, the globe, which is held on separate supports projecting from a ring supported on the outer reflector so that an air passage is formed between the globe and the ring above the reflector through which the whole of the air supply passes from the outside of the lamp. Part of the air passes around the inner reflector and to the mixing tube, while the remainder passes downwards into the space between the globe and the burners.

The lamp shown (p. 168) is built-up on a casting attached to the gas supply pipe. The products of combustion pass up out of the lamp through the inner spinnings B C, and escape through the aperture D. Brackets at intervals around the lamp are bolted to the spinnings B, and to these brackets is bolted the outer spinning of the lamp. The



Anderson's Gas-Lamp.

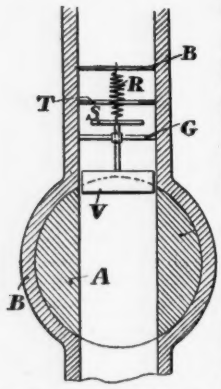
outer reflector H is preferably hinged to the spinning F. Fitting over the upper flange of the reflector is provided a ring K, having projections on its upper side, on which the globe is supported by its outwardly-turned flange. The air supplied to the mixing tube passes up between the globe and reflector over the ring, between the projections, and between the brackets to the apertures P in the air regulator. The air to the outside of the burners passes up between the globe and the reflector, between the projections, and between the globe and inner reflector—the edge of the globe thus being cooled on both sides by the air.

Safety Devices for Gas Lighting and Heating Installations.

TRAVERSAY, C. G. P. S. DE, of Versailles, France.

No. 14,874; June 27, 1913. Convention date, July 23, 1912.

This invention has for its object to provide a safety device which will notify, at the time of closing the meter, when any one of the cocks or burners in the installation has been left open. Thus, if any burner has been left open, it is impossible to close the tap arranged in front of the gas-meter, "as in order to stop the gas supply it is necessary to first close the burner which had been left open through oversight."



De Traversay's Safety Device for Gas-Taps.

The safety device comprises a tap or cock in front of the meter, having a lock connected to a valve which can be closed under the action of a spring or weight; the tap or cock being locked in the open position by the gas (when flowing) acting on the valve to cause the lock to engage the tap or cock, and thus prevent it being closed until the flow of the gas is stopped by closing all the burners in the installation.

A is the plug of the cock or tap, movable in a casing B. A lock V—consisting of a metal plate—is connected to a valve or valve disc S, which a spring R (or a counter-weight) tends to keep against the seat T so long as the gas is not flowing. When, however, the valve disc is closed, the lock, being raised, does not interfere with the motion of the plug, but the gas when flowing depresses the valve, and with it the bolt which, entering the passage in the plug, retains it in the open position, so that the tap cannot be closed until the flow of gas is arrested by closing all the burners.

In the arrangement shown the valve disc S, suitably connected by a stem to the lock V, is suspended by a spring R to a cross-bar B, the lock V being guided at G so as to be always perpendicular to the movement of the plug.

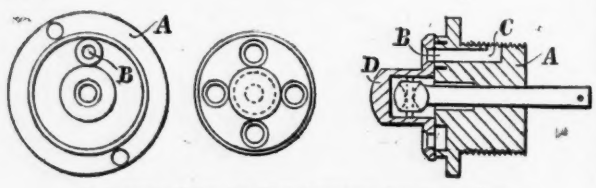
Valves for High-Pressure Gas-Controllers.

ANDERSON, J., of Edinburgh.

No. 14,798; Aug. 14, 1912. Re-dated June 26, 1913.

This invention relates to valves for use in connection with gas-controllers as described in patent No. 18,674 of 1912, and has for its object to provide an improved high-pressure valve.

The diagrammatic illustration shows a plan of the stationary plate, a plan of the rotary plate, and a sectional elevation of the complete valve.



Anderson's Valve for High-Pressure Gas-Controllers.

The "rotary valve" is in two parts—a stationary part and a moving part. The stationary part A is provided with a central annulus and an annulus of greater diameter and smaller width "accurately ground for a valve seat." Within the latter annulus is a gas-port B, also accurately ground, leading to a passage C in the periphery of the fixed part. The moving part of the valve comprises a plate, one side of which is ground to seat on to the fixed part, and four holes are drilled through the plate to register with the gas ports during the rotation of the valve—the plate at other times cutting off connection. The movable part of the valve is formed with a head D, to which the valve rod is attached by a universal joint constituted by a ball and pin in loose connection. The valve rod carries at its free end a pin for enabling connection with the operating mechanism to be made.

The valve above described may be applied in connection with the gas-controllers referred to in the 1912 patent. There a light spring is employed to keep the rotary part of the valve seated against the fixed part, and the shaft of the rotary part is connected with the controller mechanism. By means of the present invention it is possible to construct "an efficient and reliable valve capable of making a high-pressure gas-tight joint without stuffing-boxes, giving also a self-cleaning arrangement and operable with little friction."

APPLICATIONS FOR LETTERS PATENT.

21,923.—EASY, A. J., "Gas-lamps." Sept. 29.
21,978.—SEAGER, J. A., "Producer-gas apparatus." Sept. 30.
22,032.—SPURGE, J. B., "Controlling gas pressures." Sept. 30.
22,049.—DEUTSCHE LICHT INDUSTRIE G. M. B. H., "Acetylene generators." Sept. 30.
22,053.—WISE, F., "Gas-generating apparatus." Sept. 30.
22,061.—BASTIAN, W. B., "Gas water-heaters." Sept. 30.
22,116.—WADE, H., "Mantle-support." A communication from the Continental-Licht-und Apparatebau G.m.b.H. Oct. 1.
22,133.—STIMSON, E. F., "Gas-cookers." Oct. 1.
22,192.—STOTT, J., "Inverted lights." Oct. 2.
22,194.—KIRKE, P. ST. G., "Combustion of solid fuel." Oct. 2.
22,197.—BURDICK, C. L., "Recording-device for meters." Oct. 2.
22,212.—AHLGRIMM, U., "Dry meter." Oct. 2.
22,227.—KENT, W. G., "Recording mechanism." Oct. 2.
22,255.—ZINSER, E., "Gas igniter." Oct. 2.
22,258.—POORE, G., and LEE, G. P. M., "Producing oil gas." Oct. 3.
22,280.—WINN, P., and WILKES, A. H., "Gas-burners." Oct. 3.
23,310.—TOWNSEND, A. P., "Gas-furnaces." Oct. 3.
22,327.—ALDRIDGE, J. G. W., "Charging and discharging retorts." Oct. 3.
22,385.—AIRD, K., "Gas-fires." Oct. 4.
22,419.—MOHR, O. H., "Lighting systems." Oct. 4.

LEGAL INTELLIGENCE.

ACTION AGAINST THE FERMOY GAS COMPANY.

At the local Petty Sessions last week, the Fermoy Urban Council summoned the Fermoy Gas Company for making default in filing a return under the Gas-Works Clauses Act.

Mr. H. J. MOLONY, for the complainants, said they did not come into Court in any antagonistic or vindictive spirit, but as a matter of justice and fair play to the gas consumers. By the Act of 1871, the Company were bound to forward a statement of accounts every year, which should include all the expenditure as well as all the profits. The Council held that the statement furnished did not show all the profits. The standard rate was fixed by Parliament at 4s. per 1000 cubic feet, provided that the Company might increase or decrease the price subject to a reduction or increase in the dividend. The Council contended that the Company made certain profits out of the sale of coal and fittings which were not brought into the accounts, and the profit did not go to the relief of consumers, but to swell the dividend.

Mr. RONAN (for the Gas Company) objected that the return did not refer to coal.

Mr. MOLONY said it covered the whole ground. In any case, the accounts were not in the prescribed form, which was an offence in itself. In the form, the dividends were set out *seriatim;* but in the return made, they were together. Surely, he argued, the sum of £404 11s. 8d. did not represent the profits of the Company for the year to March last. By the balance-sheet, it would appear that there were no fittings or coal sold, though it was known that there were; and the Company were paying a greater rate per cent. dividend than the Act entitled them to do, while the sum of 5s. 5d. per 1000 cubic feet which was being charged to consumers was greater than it ought to be. The figures, so far as they went, were correct; but all the figures were not given. The Company were also bound to supply a return to the Clerk of the Peace containing full particulars of their working; this they had not done.

Mr. *A. E. Barnett*, the Manager of the Gas-Works, said the sale of coal and fittings was carried on on the same premises as the rest of the Company's business. He could not say what was the profit from fittings. A weekly report was sent to London. He could not tell the amount received for gas installations in the period to which reference had been made.

Mr. RONAN said all the Company's books were in London; but it was pointed out that the registered office was in Fermoy. The only charge against the Company was that they omitted the receipts from sale of fittings.

The Court held that the particulars supplied were not sufficient, and that there was a *prima facie* case to inquire into.

Mr. RONAN then explained that the Company was not registered under the Limited Liability Act; and had, as originally incorporated, a very general power. The original Company had power under their articles to engage in other business apart from the sale of gas—such as coal, mantles, fittings, &c. An Act of 1909 invested them with power to open the roads, and placed upon them certain other obligations. Though they had no power as a Statutory Company to sell coal, they

had it under the original Company. Parliament had since limited the Statutory Company to a certain capital; and he argued that the Bench could only deal with the capital so authorized—any sums paid for, or received for, coal outside that for gas purposes being outside the parliamentary undertaking, and, therefore, not required to be included in the accounts. Every item within the scope of the Parliamentary Order was included in the return, which was audited by a competent firm.

Mr. *R. Bruce Anderson*, a Director and Secretary of the Company, said everything outside the Parliamentary Order was kept separate and distinct. None of the capital was used for the sale of coal, and all the profits earned by the parliamentary powers conferred were set forth in the return. The secretarial work was all done in London, where the books were.

The majority of the Bench were against the production of the balance-sheet of the private Company, which Mr. Ronan said included matters that were outside the inquiry.

Witness (continuing) said that stoves, &c., were bought out of the capital of the Company, but, if sold, the profit would go to the private Company. For the purposes of arriving at a dividend, the two Companies were merged in one another, so that practically there was only one Company.

Mr. Ronan urged that the Court could not order them to give any further particulars.

Mr. Molony said the reason the Council came into Court was that they were not satisfied with the balance-sheet put forward every year by Mr. Anderson. Everything should be clear and comprehensive, so that any man might understand the figures. It was not the intention of the Parliamentary Committee that stoves should be bought by the capital of the Company, and that the profit on them should go to the private Company. The balance-sheet was "a mix-up and a juggle between the Companies." No person would believe that, with the present consumption of gas in Fermoy, the profit only amounted to £404. It should be nearer £700; and the price of gas should accordingly be reduced. The form of the balance-sheet was wrong. There was no rate per cent. shown which should be paid to the shareholders. The Council did not ask for a fine per day; they would be content if the accounts were shown.

The Court having consulted,

The Chairman (Mr. J. M. Dickson, Resident Magistrate) said they thought the balance-sheet supplied complied with section 35 of the Gas-Works Clauses Act of 1871, and consequently the case of the complainants failed, and would be dismissed without prejudice. At the same time, the Bench thought the form of accounts ought in some way to be changed, so as to render the meaning of the different items clear. It was, in their opinion, a dangerous thing to have the coal, fittings, and gas business carried on side by side, as the consumers, through the Council, had no means of finding out the profit on each item. Possibly the Board of Trade would see that a remedy was applied in respect to the accounts and the profits.

Delivering Gas Appliances by Motor.

Owing to the loss of two horses, and to the failing powers of others in the team, the Des Moines Gas Company found themselves, towards the close of last year, rather handicapped in the delivery of goods. They therefore purchased a motor-truck, which, according to an article in "Gas Record" by Mr. W. J. Bowers, has been doing very good work. On one occasion it delivered 12½ tons of 4-inch cast-iron pipe, covering 36 miles of territory in 7¾ hours, making four trips. Under local conditions this would mean five trips with one two-horse team, or 32 hours to deliver the above-named quantity of pipe. The Company have also four "runabouts," each of 700 lbs. gross carrying capacity. They are in and out at different intervals during the day, each truck making from two to five trips, and covering from 25 to 40 miles. Almost all orders received on the 9 a.m. and 1 p.m. messenger delivery are completed the same day—that is to say, the consumer buys a lamp, fitting, or small appliance with hose connection before 1 p.m., and it is generally in use on his premises by 5.30 p.m. Ranges, water-heaters, and miscellaneous large appliances are delivered by the large truck and connected by fitters on bicycles as rapidly as possible after purchase.

Public Lighting Question at Banbridge.

A motion before the Banbridge Urban District Council on Monday last week for securing tenders for the lighting of the public streets "by gas or electricity" for a period of three years, was met by an amendment, moved by Mr. R. W. Glass, to the effect that, "in view of the extent to which incandescent gas is supplanting electricity for the purpose of public lighting, and of the very doubtful prospects of success of newly-formed electric lighting companies, which render uncertain their power to fulfil a three-years' contract," the Chairman was of opinion "that no further expense should be incurred in connection with electric light," that the Council should await the result of experiments now being tried in Dromore (co. Down), and in the meantime should give the Gas Company's offer for the lighting of the town by incandescent gas a fair trial—this kind of lighting being as cheap as and considerably better than an electric installation that is unlikely to be permanently successful. Mr. Glass, in submitting his amendment, characterized the motion as really an attempt to bring in electric light in competition with gas. Some of the ratepayers were of opinion that there had been enough expense incurred in connection with the electric light question. In nearly every town in England they might observe that the electric light was being discontinued and incandescent gas substituted. He had recently seen both lights in adjacent streets in London, and could assure the Council that there was no comparison between the electric light and the gas. The latter was the better light in every sense. Mr. G. F. Power, supporting the amendment, referred to the recent Board of Trade inquiry into the question of electric light for Banbridge, and the refusal of the Board of Trade to sanction a scheme of the kind. It was very strange, he said, that within two or three months this proposal should have been brought forward. In the result, the motion was carried by a majority of two.

MISCELLANEOUS NEWS.

HIGH-PRESSURE GAS LIGHTING IN LEEDS.

Extension of the System to the Market Hall.

The high-pressure system of gas lighting has proved so satisfactory in Leeds that the Corporation are at the present time taking steps to extend it considerably.

It may be remembered that about twelve months ago the Markets Committee decided, after prolonged inquiry, to adopt the system for the lower area of Kirkgate Market. Upwards of eighty 1000-candle power lamps were erected, displacing 120 electric arc lamps. This installation has proved so satisfactory in every way, both for efficiency and economy, that it has now been extended to the Market Hall.

According to some particulars given in the "Yorkshire Evening Post" last Friday, the lamps adopted for the hall are each of 1000-candle power, with a circular opal screen in place of the ordinary reflector, in order to allow a small proportion of the light emitted to pass in an upward direction to light the ornamental columns, girders, and roof principals. Two lamps of 1500-candle power have been placed at the two main entrances to the hall, and one in the centre of the hall, from which the clock tower has been moved.

The installation was lighted for the first time last Thursday night; and the Markets Committee are to be congratulated upon the fine effect produced. The light is white and pervasive and very uniform; and it is confidently predicted that the system will now be looked upon as the best of general market lighting in the country. The system has already been adopted by many business houses in the centre of the city for lighting their shop windows, and the effect is in marked contrast to anything that has been seen before.

In order to call the attention of shopkeepers generally to the immense advantages of the lights, the Gas Department is sending out circulars on the subject. In these it is urged that the light given by high-pressure gas, besides being steady, brilliant, and reliable, is the best and most restful for the eyes. It is pointed out that the cost per hour for a 1000-candle power lamp, for gas only, works out approximately at ½d. per hour; and for a year, assuming that the lamp was lighted for 800 hours, the total running charges, including gas and maintenance, would be £3 3s.

ILKESTON GAS UNDERTAKING.

Further Angry Recriminations.

Methods or manners regarding public discussions upon affairs concerning the management of the Ilkeston Corporation gas undertaking do not appear to be improving. At the last meeting of the Council, there were further angry recriminations arising out of incidents connected with the reinstallation of the gasholder. With the closing of the incidents connected with the treatment of Mr. F. C. Humphrys, the former Engineer, there seemed reasonable ground for the anticipation that the last had been heard of an unpleasant business; but the storm broke out with renewed violence on Tuesday. The matter arose in reference to the letting of the contract for the reinstallation of the damaged holder.

The debate, in the course of which the Town Clerk made a spirited reply to certain insinuations, arose upon a resolution, of which Mr. W. Smith had given notice, requesting the Chairman of the Gas Committee to afford a full explanation of the serious delay in the reinstatement of the No. 3 gasholder, and instructing the Town Clerk to lay before the Council "all the documents and agreements containing the terms and conditions under which such reinstatement is to be carried out, and to read to the Council the Gas Committee's minute authorizing the work to be done, and accepting the terms on which the work is to be carried out." Mr. Smith claimed that there must be some reason for the delay in the reconstruction of the holder, and explained that his object was to find out the cause, as also the actual facts regarding the reinstatement. Nearly two years had elapsed since the matter was taken in hand, and there had been so much secrecy about the whole business that he thought no one could be blamed for thinking there was something wrong.

Mr. E. Smith, who seconded the resolution, stated that twelve months since they were informed by the Town Clerk and Mr. Macdonald, one of the members of the Gas Committee, that an order had been placed regarding the new gasholder. It was understood that there had been no formal contract, but that a certain bargain had been effected in the matter. What reason, however, was there for believing that the bargain was a good one, seeing that there had evidently been an intention to keep the majority of the Council in the dark. A "fairy story" of some kind had had to be related to the Council regarding the matter, after the general body of members had been overridden and the work let for £2300 without their knowledge.

The Town Clerk explained that twelve months ago he submitted a report to the Council. The whole of the transactions regarding the finances of the Corporation were then explained in detail to the Council; and this was one of them. The terms and arrangements with regard to the building of the gasholder were given to the Council upon the occasion referred to. Further than this, he asked Councillor E. Smith if he could deny the fact that, when he came to the Town Clerk's office and asked him privately the terms of the contract, he (the Town Clerk) told him that if he would keep them to himself he would tell him what the terms were.

Mr. Macdonald ridiculed the idea that there had been serious delay regarding the reconstruction of the holder. Work in connection with the brick and puddle tank was begun in November, and they did very well to complete this portion by July. The work of reinstating the envelope had been in progress since. Despite the fact that riveters and fitters were difficult to obtain, not only was the bottom lift of the holder in position and finished, but the top lift was so far completed

that within the next few days, if the weather held good, they would be putting the roof on. It was expected that the holder would be ready for use in November, in time for the Gas Committee to have sufficient storage for the foggy winter nights. They had the assurance of Mr. Glover, their expert adviser, that the tank and holder would be erected practically in record time. Mr. Glover had also expressed his satisfaction with the excellence of the work.

After some further remarks, the resolution was put and defeated—only Councillors W. and E. Smith voting in its favour.

THE STOCKPORT GAS-WORKERS' STRIKE.

Negotiations for a Settlement.

Our Manchester Correspondent says it is now confidently anticipated that the Stockport gas-workers' strike, which has lasted sixteen days, and is estimated to have cost about £100,000, is drawing to a close. Hopes are entertained that the men will return to work almost immediately. After Friday's meeting of the Gas Committee, a statement was sent to the Strike Committee that the former were prepared to take back all the men, but that they must apply in writing for their positions; the arrangements for their return being left in the hands of the Gas Engineer (Mr. S. Meunier). The Strike Committee, however, did not consider the letter satisfactory. They strongly objected to applying for their positions in writing, and said they would only return to work in a body. A representative of the Municipal Employees' Association also expressed the opinion that the reply of the Committee was not sufficiently definite. Another point raised by the men's officials was the treatment of the strikers on their return to work. The men, it is stated, regarded the Committee's decision to decline to take them all back at once as a move on their part to defeat the effect of their offers of re-instatement. The men's representatives, however, attended a meeting of the Gas Committee last Saturday morning, when it was explained that the Committee had no such ulterior motive. Their only objection to the return of the whole of the men in a body was that it would take some days before the works would be in a condition in which the services of all the men would be required.

Another meeting of the men was held on Saturday night, when the Committee's explanation of the proposed agreement was considered. It was subsequently also announced that practically all the differences had been settled, and an agreement drawn up which was stated to be acceptable to both sides. The men at work are to be retained; but all the strikers are to be re-instated as soon as possible. The only question now remaining is that of the workers in the various other departments who came out "in sympathy" with those on strike. Mr. P. J. Tevenan, the General Secretary of the Municipal Employees' Association, of which the strikers are members, said he confidently hoped that it would be found practicable to restart work all round on Monday (yesterday).

The Gas Department have issued a notice to manufacturers stating that they hope to provide a full supply of gas for lighting purposes for mills and workshops for to-day (Tuesday), and for industrial purposes on Wednesday or Thursday.

A Settlement Effected.

Telegraphing last night, our Manchester Correspondent said: The Stockport strike was settled this afternoon, and operations at the gas-works will be resumed to-night, and in the other departments to-morrow morning. This happy result was announced at a meeting of the strikers, at which Mr. Tevenan referred to an interview with the Mayor, who had drawn up terms of settlement. The Mayor assured the men that he would use his influence to prevent victimization. It is realized that the strikers have gained little.

STAFFORD CORPORATION GAS UNDERTAKING.

Large Extensions Foreshadowed.

At the Meeting of the Stafford Town Council last Tuesday, Alderman C. H. Wright, the Chairman of the Gas Committee, submitted a report on the gas undertaking. Referring to the proposal of the Committee that application should be made to the Local Government Board for a Provisional Order to enable the Corporation to borrow £50,000 for the gas undertaking, he said the recommendation was made in consequence of the Board having imposed new regulations which insisted upon corporations only making one application in twenty years. The Stafford gas undertaking was on the threshold of a considerable expenditure; and the Committee had therefore made an estimate of £50,000 for the next twenty years. He had foreshadowed, during the past few years, that the time was coming when they would require a new gasholder; and it had now arrived. At present their storage was not more than one-third of the minimum recognized by the profession. They had made such rapid strides since their last increases of plant, in 1892 and 1894, that the annual output was now 230 million cubic feet, compared with 123 millions in 1894. Therefore, if the gasholder accommodation they put down in 1894 was then considered necessary, it would be seen that they were now far short of having the desired quantity. The probable cost of increasing the storage would be well over £10,000. They also required to enlarge their carbonizing plant; and this expenditure would also be necessary next year. With the improved methods of manufacture to be brought into use, they hoped to increase their profits to such an extent that they would be able to pay both the instalments of the sinking fund and the interest on the money to be borrowed.

OSSETT GAS-WORKS EXTENSIONS.

Local Government Board Inquiry.

As briefly mentioned in the "JOURNAL" last week (p. 58), an application by the Ossett Corporation for sanction to borrow £40,000 for the purpose of extending the gas-works was the subject of an inquiry held at the Town Hall on the 2nd inst. by Mr. T. C. Ekin, M.Inst.C.E., one of the Board's Inspectors. Particulars of the scheme have already been given in the "JOURNAL." The case for the Corporation was presented by Mr. B. Greenwood, Solicitor, and the Gas Engineer and Manager (Mr. A. E. Mottram); and a representative of Messrs. Leech, Goodall, and Co., Limited, of Leeds, who have secured the contract for an installation of Dessau vertical retorts, was also in attendance.

Mr. GREENWOOD opened the proceedings by giving particulars of the gas area of the Corporation, rateable value, &c. The total of the former was 11,088 acres; the gross annual value of Ossett was £72,547; and the assessable value, £55,023.

Mr. MOTTRAM, replying to the Inspector, stated that no existing works would be superseded by the proposed outlay, and that the only new works commenced were purifiers and a washer. The Corporation did not at present propose to carry out the whole of the works comprised in the scheme, but only to spend £26,000 or £27,000. They must, however, complete it within the next few years. By the Gas Act they had power to spend £25,000 in extensions; and this was the first application made to the Local Government Board.

Mr. GREENWOOD, explaining the Corporation's financial powers under the Act mentioned, stated that the whole of the £25,000 had been expended except £1490. Since the gas undertaking had been acquired, the consumption had increased enormously—not by a sudden movement, but by steady growth. From the 31st of March last, the increase had been at the rate of 19¾ per cent., or 165,000 cubic feet per day. This made the extension of the works imperative; and the Corporation had decided to put in an installation of vertical retorts, with a railway siding on to the works, and mechanical coal-handling plant. It was estimated that by the last-named plant there would be a saving of 2s. per ton, or £1570 a year.

Mr. MOTTRAM put in, and explained, a statement showing that the cost of 14,000 tons of coal, which would be necessary to meet the consumption of gas of next year, would, including carbonizing, be £10,264. Deducting £7861, the value of the residuals, the net cost was £2403. To produce the same quantity of gas by vertical retorts, 11,300 tons of coal would be required, as 14,000 cubic feet of gas per ton of coal were guaranteed. Coal was taken at 12s. per ton in each case; and the cost of carbonizing would be considerably lower. As less coal would be used, there would be fewer residuals; but there would be a balance of £1500 in favour of vertical retorts. With regard to the amount of interest and sinking fund required, his calculation was worked out on a basis of 25 years' repayment. There would also be a saving on the railway siding, as it now cost 7½d. a ton to cart the coal; and credit had been taken for the profit on 17 million cubic feet increased consumption, which would accrue by the time the new plant was working. Having explained that from 1901 to 1913 the quantity of gas sold had increased from 70,843,500 to 131,186,500 cubic feet, the number of consumers from 3452 to 8347, and the mileage of mains from 32 to 53, and that, while the total capacity of the works was 750,000 cubic feet per day, last winter 722,000 cubic feet were sent out in one day, witness proceeded to describe the Dessau vertical retorts, and also, with the aid of plans, the scheme for the further extension of the works as the consumption increased—pointing out that it was so arranged that the retort-house could be conveniently enlarged to a capacity of 4½ million cubic feet per day.

Particulars having been furnished the Inspector as to the amounts which the Corporation did not propose to spend immediately, or within the next two years, which came to £9570, he excluded this sum from the £40,000 applied for; reducing it to £30,430, *plus* 5 per cent. for contingencies, legal expenses, &c. It was intimated that the Local Government Board might express approval of the complete scheme; and in that case it was probable that, when the Corporation made up their minds to carry out the works left over, another inquiry would not be necessary.

The INSPECTOR asked if there was any opposition to the application.

Mr. A. B. GLOVER said he opposed it. He thought the Corporation should be allowed as little time as possible for the repayment of the loan, as the plant might be out of date in thirty or forty years. He criticized a proposal by the Corporation to extend their mains to Midgley, at a cost of £900, and said the income would not be an adequate return on the outlay. He submitted that they should not go into new districts, and said the plant was large enough for their own area at present.

Mr. J. W. SMITH said, as one of the largest ratepayers, he opposed the application; his contention being that the scheme would not pay. For five years it would be a dead-loss. He did not say that he could give much proof of this; but the Manager had not given any that it would pay. He had not proved that they would get a profit on the £27,000.

The INSPECTOR reminded Mr. Smith that both Mr. Greenwood and Mr. Mottram had gone rather fully into this point. He thought Mr. Greenwood had been able to show that a profit had been made on the gas undertaking—nearly £11,000 in ten years.

Mr. SMITH: £11,000? Fiddlesticks! They can't show it legitimately—half.

The INSPECTOR: You are standing up now, making allegations against Corporation officials that they put in fraudulent figures.

Mr. SMITH: I stand here and make the charge that they cannot legitimately show £11,000 profit. I affirm that.

Mr. LUND (the Borough Treasurer) said that, as the official involved, he thought Mr. Smith should be called upon to withdraw this charge. He added that the accounts were audited by an eminent firm of chartered accountants.

Mr. GREENWOOD also said the statement reflected upon him, that he placed before the Inspector figures that could not be vouched for.

The INSPECTOR pointed out to Mr. Smith that he was making serious allegations, and had said he would stand by them.

Mr. SMITH said it had not been shown to him that £11,000 profit had been made.

The INSPECTOR: Perhaps your head is rather thick, and you cannot see these things. That is not the fault of the Corporation. You must not come here and make the serious allegations you have done, unless you are prepared to bring forward proof. I want to know what your reply is to the statement of Mr. Greenwood and the Borough Treasurer that the accounts have been properly audited by a firm of accountants. Yet you say they are not correct. What proof have you?

Mr. SMITH: I think they have not made this profit. Will they stand up and say their balance-sheet shows £11,000 profit?

The INSPECTOR: The actual amount is £10,792.

Mr. SMITH: Then, of course, I accept it, if you are satisfied with that.

Mr. LUND said he thought Mr. Smith ought to withdraw the charge he had made.

The INSPECTOR said he certainly considered this should be done.

Mr. SMITH then withdrew his charge, and subsequently admitted that he had not looked at a balance-sheet for seven years.

The INSPECTOR expressed surprise at this, and asked Mr. Smith to resume his seat.

Mr. SMITH, however, proceeded to question Mr. Mottram on the subject of the illuminating power of the gas, and as to getting the promised yield of 14,000 cubic feet per ton. On being satisfied on these points, he inquired what was to be the calorific power of the gas.

Mr. MOTTRAM said it was between 500 and 530 B.Th.U.

Mr. SMITH: I mean in Board of Trade units. [A laugh.]

The INSPECTOR: In what?

Mr. SMITH: In Board of Trade units.

The INSPECTOR: That shows you are absolutely ignorant of what you are talking about. If you said British thermal units I could understand. Sit down, please.

Mr. SMITH: I want to ask a few more questions.

The INSPECTOR: Sit down; I won't hear you. Such rubbish! Board of Trade units for a gas supply!

Mr. W. TAYLOR said he wished to dissociate himself from the statements just made. He, however, raised the question of depreciation, and remarked that the structure was mainly concrete and girder work, and in the district the acids in suspension in the air had a serious effect on steelwork, the life of which was shortened. He also said he was the largest customer of the gas-works for coke; and he wished to know whether that made in vertical retorts was suitable for domestic use. If not, the poorer people would suffer, as a great deal was used.

Mr. MOTTRAM replied that, at the works which had been visited, coke from vertical retorts was sold in preference to that produced in horizontal retorts.

Mr. TAYLOR said at two works within twenty miles of Ossett, where vertical retorts were used, he had seen coke for which he would not give 2s. a ton. It would not suit a single customer he had for engineering purposes. He suggested that there would be considerable depreciation of the plant, and that the retorts would require replacing frequently.

Mr. MOTTRAM, however, said that undoubtedly the life of vertical retorts was longer than that of horizontal retorts, and the cost of renewal was a great deal less. He had seen some which had been in use four or five years, and they were still in good condition.

Mr. TAYLOR said he was not opposing the application, but he asked that the Local Government Board should take reasonable precautions and secure proper safeguards.

The MAYOR (Mr. H. Robinson) made a few remarks, emphasizing the necessity of increasing the capacity of the works, and the obligation on the Corporation to serve the districts within the statutory gas area. He urged that as long as possible should be granted for repayment. He added, in reply to the Inspector, that, while on the Town Council there were differences of opinion as to details, they were absolutely unanimous on the principle, and as to making the application.

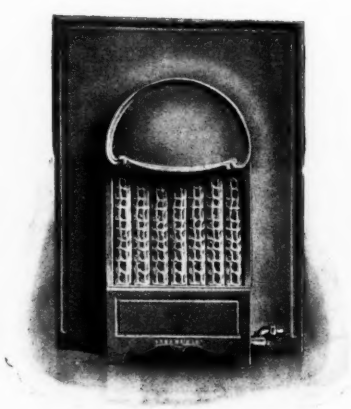
The INSPECTOR intimated that he intended to visit the works. The Mayor said Mr. Smith had requested to be allowed to accompany him; but the Inspector did not consider this necessary.

ELECTRICITY FOR POWER AT LONG EATON.

Alleged Unfair Trading by the District Council.

Trouble arising out of alleged unfair trading is threatened at Long Eaton. Strained relationships which have for some time existed between the Urban District Council and the Gas Company have at length reached an acute stage; a writ having been issued by the Company against the Council for alleged unfair trading. The matter arises out of the rates charged by the Council for electric current for lighting and power purposes, of which they have the supply. The effect of the Council's action, it is contended, has been to interfere unwarrantably with the legitimate business of the Company; it being asserted that, in their attempt to foster the interest of the electricity undertaking, the Council have gone almost to the extent of selling current at less than cost price. In view of the threatened litigation, it is not at this juncture permissible to indicate in other than general terms the conditions which have led to the dispute; these being more or less matters of public property. It has been the custom of the Council to supply electricity to large consumers for power purposes alone at the rate of 1d. per unit; but, where the current was employed both for illuminating and motive power, only ¾d. per unit, less 5 per cent., was charged for power. Naturally the effect of such an arrangement has been inimical to the interests of the Gas Company; and herein the complaint as to unfair competition arises. Instances of considerable loss of trade to the Company have been brought under notice in support

"MAIN" MEANS MINIMUM MAINTENANCE.



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The number of parts in the "D.S.O." Fires has been reduced to a minimum. No Screws or fastenings are used in fitting the burner, fuel, brick, or fender, which means perfect interchangeability. The burner can be made right or left hand at will.

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Will pass any test for Hygienic Efficiency.

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of the threatened proceedings, in taking action in regard to which the Directors are understood to be acting upon very high legal authority. The case obviously presents all the essential elements for subtle legal disputation; but, meanwhile, the feeling appears to be growing locally in favour of a *modus vivendi*, which would afford ground for a settlement equitable to both parties.

UNPROFITABLE ELECTRIC LIGHTING IN SOUTHWARK.

Selling Electricity at Less than Cost Price.

The accounts of the electric light undertaking of the Southwark Borough Council for the past year show a net loss of £1893 on the twelve months' working. The Committee, in a report presented to the Council, stated that this was mainly attributable to the high prices paid for coal during the strike. While looking upon the loss as the result of an abnormal condition of circumstances affecting the undertaking, they felt that a thorough investigation into its administration and working should be made, with the view of preventing, if possible, any further deficit; and they recommended the Council to appoint a Special Committee for the purpose. The report and accounts were presented to the Council at a meeting on Friday last.

Mr. W. T. LAYTON inquired the reason for charging the public lighting at 3¼d. per unit, while the average charge to private consumers was only 2¼d. per unit. If the charge for public lighting had been the same as for private lighting, an extra £1000 would, he said, have been added to the year's loss.

Mr. A. KING said twelve months ago the Council expended £30,000 in extending the plant, and at the time some members objected to it until they had seen a full year's working of the turbine system. This they now had, with the result that the undertaking showed a loss of £1893. In the last three years, they had lost upwards of £2000 on the undertaking, against £1800 profit made in the preceding three years The loss last year was equal to a rate of ½d. in the pound. There was a great slump in the prices charged for lighting; and for the first time in their history they had sold 6288 units at ½d. per unit. The cost of generation was 2·034d. per unit; and he urged the Committee to consider seriously the readjustment of the scale of prices, as the Council had no right to sell electricity at less than cost price.

Mr. A. WILSON said there was only one cause for the deficiency—the abnormal cost of coal. He agreed that the Council had no right to sell electricity at less than cost price; but he pointed out that they had to give favoured terms to manufacturers, in order to induce them to take premises in the borough. They were justified in letting them have electricity at a cost that would not be a burden on the ratepayers.

Mr. F. W. WARD, the Chairman of the Committee, said he was perfectly satisfied that the loss was due to abnormal circumstances, and that a great deal of the extra expenditure would not occur again. On account of the bad coal, the cost of generating current was much higher than it should be.

The Council adopted the report, and appointed a Special Committee to investigate the administration and working of the undertaking with a view to obviating any further deficit.

LIMAVADY GAS UNDERTAKING.

Charges against the Gas Committee.

Charges which had been brought against the Gas Committee of the Limavady (co. Derry) Urban District Council were the subject of a rather animated discussion at a recent meeting of that body.

The CLERK said it had been alleged that the unsuitability of the coal was the main reason for the failure of the gas undertaking to pay its way; that coal had been purchased at a price per ton higher than the current market rate; that the Gas Manager (Mr. R. Gault) had not been consulted as to coal purchases; that the Committee's Secretary [the Clerk himself] had suppressed, or had failed to submit, a written statement from the Manager to the Council; that the Secretary harboured *animus* against the Manager; and that the financing of the undertaking was bad. Replying to these charges, he said it was well-known that gas managers differed as to the best kind of coal for the manufacture of gas. The coal in use in the Limavady works was the same as that employed in the most thriving gas-works in Ulster—such as those at Belfast and Omagh. Even were it otherwise, the figures which he now submitted, as supplied by the Manager, showed conclusively that the quantity of purified gas obtained from the coal in question was very large; and if even a reasonable portion of the yield obtained by the Manager had materialized in cash at 5s. per 1000 cubic feet, in the year ended March, 1913, there would have been receipts from gas sold of £1210, instead of £705. He held that the coal used could in no way be accountable for the present position of the undertaking. The Manager had not admitted that the extraordinary waste had arisen to any appreciable extent from defective mains. No attempt had been made to substantiate the charge of purchase of coal above the current market price. The charge of non-consultation of the Manager was paltry and untruthful; and another charge was disproved by the fact that the statement not submitted to the Council was clearly addressed to the Gas Committee. He examined this statement in detail; remarking that it claimed that if the coal recommended therein had been used instead of that employed in the past, a saving of 2s. 6d. a ton would have been effected—making, on 500 tons a year, a saving of £62 10s. But as one quality of coal recommended by the Manager was only 3d. per ton lower than that in use last year, and the other was 6d. per ton higher than the coal of the quality he had condemned, his 2s. 6d. per ton and his saving of £62 10s. disappeared. When he (the Clerk) consulted with the Manager, it was agreed that

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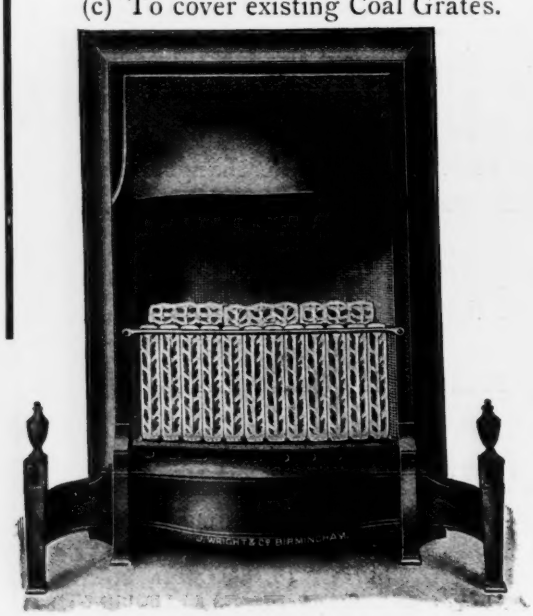

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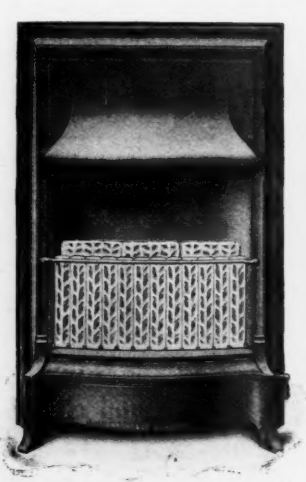

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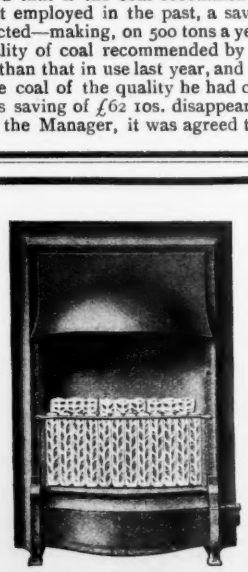

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the latter should report the necessity of using some other kind of coal. The Manager then recommended two kinds; but one was 9d. per ton and the other 1s. 6d. per ton dearer than that selected.

Ultimately, satisfaction was expressed at the result of the discussion to which the Clerk's statement gave rise.

ELECTRIC LIGHTING LOSSES AT CARNARVON.

In reply to a protest against the action of the National Electric Construction Company in increasing the price of electricity, the Company wrote to the Carnarvon Corporation to the effect that they had up to date lost £7000 on the working of the undertaking. It appears that the Company early last month circularized their customers to the effect that current for lighting purposes would be increased from 5d. to 6d. per unit after the 25th. The Town Clerk had been asked by the Electricity Committee to write to the Company reminding them of their statement that they would not be likely to increase the price beyond 5d. per unit. To this the Company's Managing Director replied that if the conditions had remained the same as they were in 1904, the price would not have been raised; but they were in the same position as any manufacturer whose cost of production increased. They had lost up to date about £7000, after paying the sinking fund and interest instalments. It was as much in the interests of the Corporation as in those of the Electric Company that every attempt should be made to put the undertaking in a position to earn a profit to cover at least the capital charges. At a meeting of the Town Council last Tuesday, the Electricity Committee presented a report in which they recommended that the Company should be informed that the increase in the price was against the best interests of the undertaking. This contention, they said, derived support from the Managing Director's statement in 1904 that if the undertaking would not pay with electricity at 5d. per unit, it would not pay at 6d. The report was adopted.

LEEDS AND THE DONCASTER WATER SUPPLY.

The Scheme Sanctioned.

At the Meeting of the Leeds City Council last Wednesday, the scheme for the supply of Doncaster with water, which has been under consideration by committees of the Corporations of the two towns, was submitted.

Alderman A. W. WILLEY moved—"That, subject to an agreement to be approved by the Town Clerk, and to the obtaining of the necessary parliamentary powers, a supply of water be furnished to the Doncaster Corporation." In outlining the scheme, he remarked that there was absolute unanimity in the minds of all those who had anything to do with the present proposal, which was that Leeds should for all time agree to supply Doncaster with water. They were all satisfied that a provisional agreement as to terms would not serve the interests of either town. Shortly, the terms were that Leeds should supply Doncaster, if required, with 2 million gallons of water per day. Doncaster guaranteed to pay for at least half-a-million gallons a day, whether they took it or not, from the time the pipes were laid down, and to pay Leeds at the rate of 8d. per 1000 gallons. If, after getting the maximum quantity, Doncaster were in the position of demanding by necessity a larger quantity, they could give Leeds notice, and receive up to 4 million gallons a day at the same price. The cost of the scheme, including the construction of a five-days' storage reservoir, would be £120,000, allowing for an 18-inch main to convey the water. Such a main would carry the greater part of the 2 million gallons; but if other districts desired to be supplied with water, and Doncaster decided to exercise their option, the 18-inch pipe would not meet the requirements, and the result would be that in about 25 or 30 years Leeds would have an extra pipe to lay. But for an extra cost of £20,000, Leeds could put down in the first place a 21-inch main, guaranteed to carry 3½ million gallons at least. Without this precaution, in the future the whole pipe would have to be laid, and there would have to be faced once more all the difficulties of dealing with owners. Leeds had to provide the capital expenditure involved, which, allowing for a 21-inch main, meant £140,000. Doncaster had met Leeds with great candour and openness, and Leeds was in the happy position that in no circumstances could it lose money by the transaction. At present, Leeds had about a million gallons of water a day to spare. Even at the time of the very worst drought in their experience, they had never had less than 60 days' supply. When the Leighton reservoirs were completed, the city would have an additional 4½ million gallons per day; and Leeds was not likely, for certainly twenty years, to want more than 2 millions increase per day as compared with the present consumption. Therefore, they would have 2½ million gallons a day to spare. He and his colleagues on the Committee had come to the conclusion they could sell at a reasonable cost 2 million gallons of water a day, which would bring into the coffers of the city from £24,000 to £25,000 a year. At present water was running to waste; and therefore the city had everything to gain, especially if, as he believed, they were satisfied that the water would not be wanted. The project was one of the most important that Leeds had ever had to consider; and the Town Clerk (Sir Robert Fox) regarded it as an extremely good bargain for all concerned. In conclusion, Alderman Willey paid a tribute to the excellent services rendered by Alderman C. H. Wilson, Alderman Kinder, the Town Clerk, and the Water Engineer (Mr. C. G. Henzell, M.Inst.C.E.).

Alderman PICKERSGILL seconded the motion, and, after a few remarks, it was carried.

Mr. W. J. Claude Cotton, late of the mains department of the Tottenham and Edmonton Gas Company, and representative for the Lead Wool Company, has been appointed northern representative to Messrs. G. Hands and Co.

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NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

All good gas managers are planning to visit Shepherd's Bush during this month; and a few impressions which the exhibition made upon one may be interesting to those who have not yet seen it, and may or may not be intending to walk its long length. Whoever conceived the idea of using the corridor leading to the "White City" deserves all credit, as it most excellently serves the purpose, is of just the right width, and has been delightfully fitted up and decorated. In this last respect the exhibition is quite complete; but, alas, the spectacle of men still fitting pipes, burners, and gas apparatus all over the place is not a very picturesque one. Surely this might be done at night, or during the morning, when few visitors are present, as outsiders, seeing new mantles being fitted, may gain the impression that only by constant renewal of mantles can this very efficient illumination be kept up. The lighting is efficient in every respect; but nowhere does it strike one as being overdone. In one part especially—one of the "rest rooms"—the light, while quite sufficient, has been tempered so that the eyes as well as the body may be rested; and for this many will be thankful.

The historical manuscripts and prints will repay a careful examination, especially those showing notes by Murdoch for plant, &c., for making gas, and the century-old prints showing the method of charge for lights, where it states that for cockspur jets, 2 inches in length, 10s. 6d. was charged annually if extinguished at 8 p.m., and higher prices for longer hours. By the way, each jet was only considered equal to three candles, and probably these were of the tallow candle kind. The opposition to the starting of what are now the great gas companies is also chronicled. A fine collection of old burners and a water-loaded governor (in a tub for a tank) are on view; the latter containing all the essential parts for satisfactory working. An early gas-cooker shows the enormous strides this branch of the industry has made. Another exhibit is of the early forms of light-holders for pine branches, oil and tallow lamps and candles, and also the methods used for starting them with flint and steel and tinder and other means. These should all be looked at carefully, as it is not often that such a fine collection can be examined.

The six divisions showing the effect of different coloured wall papers in the reflection of light should form part of most show-rooms, or at least find a place in the offices of all gas-supplying undertakings. Why not arrange a peripatetic exhibition out of the remnants of the present one when it is dismantled, which could be fitted up in each large town in turn, and thus bring before the public all over the country the advantages of using gas more generally? This might be done under the auspices of the Britsh Commercial Gas Association, so that the expense could be jointly borne by all the various manufacturers. If this cannot be arranged, then companies and corporations might be at the expense of fitting up their managers' houses on the lines of some of the suites of rooms shown at Shepherd's Bush, so that the customers might have the opportunity of seeing what is latest and best in the way of gas appliances. This arrangement could only be satisfactory if kept absolutely up-to-date and thoroughly complete in every detail, and possibly even more elaborate than the size of the house would generally warrant. Another advantage of this plan is that the manager would get accustomed to, and thoroughly understand the use of, each article, and be better able to advise would-be users upon its adoption. This appeals to one particularly in the smaller towns, where even an ordinary show-room is not at present found.

Londoners are so accustomed to electric-lighted flashing signs, that the use of gas flashing signs to indicate the halls, lecture-room, cookery-hall, &c., is taken by them as a matter of course. But to provincials they will be more of a novelty, and will probably be subjects of great interest, and noted as one of the things to be introduced in their own towns. Why not fix one outside the door of the gas office? The pneumatic and electric forms of gas-lighters are not yet sufficiently known to the general public, and whenever these are being actuated crowds soon appear and wonder at the means adopted, and expatiate upon the convenience of switching-on the gas lights in the same way as has always been done with the electric light. A clockwork finger to press the button might be fixed in show-room windows, with a suitable notice calling attention to its operations.

There is no doubt that, from the point of view of the individual exhibitor, the exhibition will not prove so successful as the more usual one, where the stands of the various makers are covered with their manufactures; but to the public there is no doubt the present arrangements appeal, as showing the effect of gas lighting and heating. The advantages of each gas appliance are more apparent; and to the gas industry as a whole the exhibition will prove of inestimable value. If the industry gains, then the individual maker will also reap the benefit in turn. One thing might be done to assist the manufacturer, and that is a careful and thorough labelling of each piece of apparatus, with its uses and maker's name, so that all who run may read. This would appeal more particularly to the visiting gas manager.

Regarding the exhibits of apparatus and products much might be said; but these have been described in detail by others. Attention might be drawn, however, to the ammonia and coal tar products which are effectively displayed at the top of the staircase. These might have been made more interesting still if arranged in groups, according to the various bases employed in their manufacture, and with labels attached detailing these sources. Messrs. Alexander Wright and Co.'s photometer-room and the testing-room, with the many testing and recording instruments which they have made such a speciality, will attract the attention of all gas managers, who (thanks to the many technical colleges) are becoming more scientific every day, and able to appreciate and understand such apparatus. Piggott's patent pressed tank plate, in 4 feet square sections, is noteworthy as an adaptation of modern methods of construction. The welded joints, connecting several pieces of steel pipe into one, to which is attached a pressure

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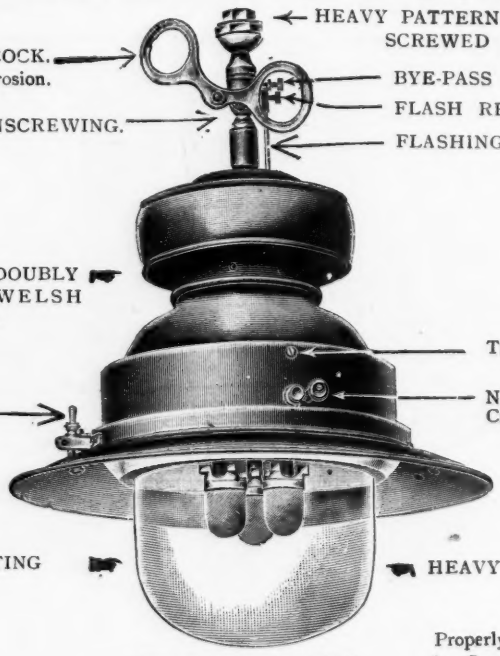
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gauge indicating a pressure of 105 lbs., which remains constant, shows how well the joints made by the Helm Lamp Company, of Nuneaton, suit for high-pressure work.

The lectures seem to be well attended; and this shows that the general public are anxious to learn more about the details of both the manufacture and the use of gas. One more grumble. The poster seen all over London, while artistic enough, hardly does justice to the lighting power of gas, nor does it, in fact, illustrate the illumination of the entrance, which is most effective, and which it is intended to portray.

The printed abstract of accounts of the Kilmarnock gas undertaking for the year ended May 15 last shows that the total quantity of coal carbonized was 21,414 tons, and the amount of gas produced 204,727,900 cubic feet. The average production of gas per ton of coal carbonized was thus 9560 cubic feet, and the quantity sold 8886 feet. The leakage was 7·05 per cent. From gas there was an income of £23,290; the total revenue amounting to £34,897.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 11.

Sulphate of Ammonia.

During the past week the lack of strength in the present situation has become more apparent, and, in order to dispose of their current production, manufacturers have been compelled to make further substantial concessions in prices. The closing quotations are £13 3s. 9d. per ton f.o.b. Hull, £13 5s. per ton f.o.b. Liverpool, and £13 6s. 3d. per ton f.o.b. Leith. In the forward position, producers are very conservative in their views and continue to quote the advanced prices they were asking before the decline in values for near delivery, but middlemen are reported to be offering at a premium of only 2s. 6d. to 5s. per ton on to-day's quotations for prompt shipment.

Nitrate of Soda.

The tone of this market continues dull, but spot quotations are repeated at 10s. 9d. per cwt. for ordinary quality and 11s. for refined.

LONDON, *Oct.* 13.

Tar Products.

There is no material change in the markets for tar products. Business remains quiet in the majority of articles. No business of note has been reported in pitch during the past week, and, if anything, prices are in favour of buyers rather than sellers. Ninety per cent. benzol is firm; and a fair amount of business has been reported. Solvent and heavy naphthas remain quiet; and although some business has been reported, the prices paid have not been particularly good. Creosote maintains its quotation, and further business has been done in this article during the past week.

The average values during the week were: Tar, 29s. 3d. to 33s. 3d. Pitch, London, 44s. to 45s.; east coast, 44s. 6d. to 45s.; west coast, Manchester, 43s. to 43s. 6d.; Liverpool, 44s. to 44s. 6d.; Clyde, 44s. 6d. to 45s. Benzol, 90 per cent., naked, London, 1s. 1d. to 1s. 1½d.; North, 11½d. to 1s.; 50-90 per cent., naked, London, 1s.; North, 11d. Toluol, naked, London, 10½d. to 11d.; North, 10½d. to 11d. Crude naphtha, in bulk, London, 5¼d. to 5½d.; North, 5d. to 5¼d. Solvent naphtha, naked, London, 10¼d. to 10¾d.; North, 9¼d. to 9¾d. f.o.b. Heavy naphtha, naked, London, 10d. to 10½d. f.o.b.; North, 9d. to 9¼d. f.o.b. Creosote, in bulk, London, 3⅜d. to 3½d.; North, 2⅞d. to 3d. Heavy oils, in bulk, London, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 1½d. to 1s. 2d. Naphthalene, £4 10s. to £10; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit; "B" quality, nominally ¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has again been a slight fall in prices, and business has also been particularly quiet. Tender parcels have not gone so well, and there has been more of the article offering. To-day's value in London is £12 10s. to £12 11s. 3d.; Hull, £13 6s. 3d.; Leith, £13 8s. 9d. to £13 10s.; Liverpool, £13 7s. 6d. to £13 8s. 9d.; Middlesbrough, £13 7s. 6d.

Changes in the Ownership of Essex Gas-Works.—On the 1st inst., the Grays and Tilbury Gas Company took possession of the gas-works at Rayleigh and Billericay from Mr. Worthington Church, under the provisions of the Act of Parliament obtained by the Company in the past session. Mr. Church has recently purchased the works at Great Coggeshall; and a supply of gas to this town will eventually be provided from his works at Kelvedon.

Proposed Amalgamation of the Slaithwaite and Longwood Gas Companies.—A scheme is in hand for the amalgamation of the Gas Companies at Slaithwaite and Longwood, two of the Colne Valley (Yorkshire) townships. A conference has already been held between the representatives of the Companies and the Councils of the two townships; and all the Councils of the Colne Valley towns are to be consulted with a view to getting their approval.

Profit-Sharing in America.—Readers of the "JOURNAL" may remember that profit-sharing has been in operation with the Boston Consolidated Gas Company since 1906. Recent statistics show that 585 employees are now included in the list of profit participants. A short time since they were allotted $50,743, or 9 per cent. of the salaries received. The scheme provides that the participants shall receive a dividend on the salaries earned at the same rate as that paid on the stock of the Company; and the amount so allotted is used to purchase preferred stock of the Massachusetts Gas Companies. There are 2730 shares of preferred stock standing in the names of the profit-sharers.

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COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is active, with a strong demand for prompt delivery, and a fair forward inquiry. The output is well taken up—the shipments of coal from the ports between Blyth and West Hartlepool averaging about 600,000 tons weekly. In the steam coal trade, best Northumbrians are from 14s. 10d. to 15s. per ton f.o.b.; second-class steams are from 12s. 7d. per ton; and steam smalls vary a good deal—from 7s. to 9s. 3d. per ton f.o.b. In the gas coal trade, there is an increase of the consumption such as is to be expected at this season. As to price, best Durhams are from 15s. 3d. to 15s. 6d. per ton f.o.b.; for second class gas coals, about 14s. per ton is the current quotation; and "Wear specials" are steady at 15s. 6d. to 15s. 10d. per ton f.o.b. Small contracts for supplementary quantities continue to be made, at a little below the values just named. A good deal of other qualities of Durham coal is now being sold for forward delivery; and this may affect the gas coal market. Best bunker coal, for instance, has been sold at 14s. 6d. per ton f.o.b. over next year; and more is being negotiated for. Coke is steady, though fairly plentiful. Good gas coke is from 17s. 3d. to 17s. 10d. per ton f.o.b., in the Tyne. Some of the inland gas-works have now increasing stocks.

Scotch Coal Trade.

A quiet tone has been prevalent in the Scotch coal trade throughout the week, in large measure due to the scarcity of tonnage and the blocking up of waggons. On the Glasgow Coal Exchange, on Friday, the following were the approximate prices quoted: Ell, best brands, 13s.; splint, 13s. to 15s.; navigations, 15s. to 17s.; steams, 13s. to 14s. 6d.; Hartleys, 15s.; trebles, 13s. 9d.; doubles, 12s. 3d. to 12s. 6d.; singles, 11s. to 11s. 6d.; pearls, 9s. 3d. to 9s. 6d.; and dross, 8s.—f.o.b. Glasgow.

Abolition of Gas-Meter Rents at Warrington.—Last Tuesday, the Warrington Town Council decided to abolish all gas-meter rents, and to give an additional 5 cubic feet of gas per penny to slot-meter users. It was stated that the concessions were equal to £5000, or 5d. in the pound on the rates. The net price of gas is now 2s. 1d. per 1000 cubic feet—the second or third lowest price in Lancashire.

Gas Supply for Ashington.—After inquiries extending over three years, the Ashington Urban District Council have at last decided to establish a gas supply. The scheme will cost between £30,000 and £40,000; and it is estimated that the whole outlay, including the redemption of capital, will not involve the Council in more than £1800 per annum, as against £2200, the lowest estimate for electric lighting. It is expected that the Council will be able, at the outset, to supply gas at 3s. 6d. per 1000 cubic feet; but if the public give the degree of support which is anticipated, the price will doubtless be considerably reduced.

New Issues of Gas and Water Capital.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards invited offers for several new issues of gas and water capital by order of Directors. The first lots consisted of £10,000 of 5 per cent. preference stock of the North Middlesex Gas Company; and it was all sold at from par to £101 5s. per £100. Some new ordinary £10 shares in the Southend Water Company, ranking for a maximum dividend of 5 per cent. per annum, but carrying 4½ per cent., fetched from £9 to £9 5s. each. A parcel of £10 "B" shares (7 per cent.) in the Grays and Tilbury Gas Company, carrying a dividend of £5 19s. per cent. per annum from the 1st prox., realized from £11 to £11 2s. 6d. per share. New consolidated stock of the Bognor Gas Company to the amount of £5000, ranking for a maximum dividend of 7 per cent. per annum, but entitled to receive the same rate as is now being paid on the Company's consolidated ordinary "A" stock—viz., 5¾ per cent.—was all sold at prices ranging from £105 to £106 per £100, *cum div.* as from the 1st prox.

Ryde Water Supply.—The new water-works at Knighton, Isle of Wight, for the supply of Ryde, were formally opened last Wednesday by Mrs. Blackall, the Mayoress. The extension was commenced in 1909, and the expenditure will be £18,000 or £19,000. The supply will extend to St. Helens; and about one-third of the island will now depend upon the works for water. The average yearly consumption is estimated at 250 million gallons; but, as the yield is 450 millions, there is ample margin for all possible increase for many years. The pumping machinery has been duplicated; each pump being capable of throwing from 45,000 to 50,000 gallons of water per hour into the reservoirs at Ashey.

Leeds Corporation Workmen's Wages.—There was a stormy discussion at the meeting of the Leeds City Council last Wednesday on the subject of the wages and conditions of service of the Corporation workmen, who have demanded an all-round increase of 2s per week. A resolution had been passed postponing consideration of the subject till after the elections; and Mr. Verity submitted a motion for its rescission. In moving it, he stated that the men had decided upon a strike, and therefore the Council should at once look into their demands. Alderman Wilson said the increases of salary asked for would involve an outlay of £25,000, and this large sum could not be found without first ascertaining whether the ratepayers were prepared to provide it. There was no refusal to deal with the matter, but merely a desire to put it off for a few days. Last year, £9000 had been granted as concessions to employees, and now the Council were asked to find £25,000. Alderman Clarke moved, as an amendment, that each Committee of the Council be instructed, on their appointment on the 9th prox., to take the various applications into consideration at once, and to date back to the 1st of October any that might be agreed to. This was carried.

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Increased Price of Gas at Falkirk.

At a recent meeting of the Falkirk Town Council, the Town Clerk read from a minute of the Gas Committee the proposed charges for gas for the current year, showing an increase of 1d. per 1000 cubic feet. The rates submitted were: For lighting and domestic purposes, 2s. 11d.; for power, 2s. 6d.; for hotels, bakeries, &c., 2s. 6d.; prepayment meters, 3s. 4d.; and public lamps, 2s. 6d.—the discounts to be the same as last year. A proposal was made that the increase should be 2d.; but it was supported by the mover and seconder only. Treasurer Wallace, in the course of his remarks in moving the approval of the gas estimates, said that, in fixing 3s. 1d. instead of 2s. 11d. as the gas-rate, they would have been doing no more than meeting the situation so far as the gas-works were concerned. The estimates indicated an anticipated expenditure on the revenue account of £30,134, and an estimated income of £42,446. They were reckoning for a balance of £12,312 to be transferred to the revenue account. On the net revenue account, they estimated to close the year with a credit balance of £196. This was accomplished by transferring £1800 of the estimate for maintenance of works to the reserve account, and £1000 in respect of the underpinning of the retort-bench, which was also to be transferred to the gas account. The figure of 2s. 11d. showed the result it did by borrowing from the reserve account of the gas undertaking £2800 for what seemed to him to be ordinary expenses. This was procedure he did not approve of. The motion was carried.

Lanarkshire County Council and the Acquisition of Gas Undertakings.

At a recent meeting of the Lanarkshire County Council, the Clerk submitted a communication from the District Committee of the Middle Ward, requesting the County Council to apply for a Provisional Order conferring powers upon the District Committee to undertake the supply of gas for public and private lighting in the Blantyre District. The Clerk said this communication had been considered by the Parliamentary Bills Committee, and they had agreed to recommend to the County Council the adoption of the following resolution: "That the County Clerk be authorized to prepare, in conjunction with Parliamentary Agents, the draft of a parliamentary notice for an Order which, while securing the particular object which the Middle Ward District Committee have in view, should, if possible, be of such general application as would apply the Gas Acts within the county in such a way as would permit the acquisition of any gas undertakings therein which it might from time to time be desirable to acquire in the public interest, and to prepare and submit such notice to the Parliamentary Bills Committee for further consideration." Mr. J. C. Pollok objected to any consideration being given to a proposal by the Parliamentary Bills Committee. He said the Middle Ward District Committee had put forward a definite scheme, and this alone ought to be considered, and he moved accordingly. In his view, the proposal of the Committee endangered that which the District Committee had been considering for months. After some discussion, Mr. Pollok withdrew his motion, on being assured by the Clerk that the proposal of the District Committee would in no way be affected by the resolution. The recommendation of the Parliamentary Bills Committee was agreed to.

The Fire-Clay Business and the Gas Industry.—In the course of an interview with a Press representative, Mr. G. H. Pearson Perry, the Chairman of the Fire-Clay Goods Section of the Society of British Gas Industries, and Managing-Director of Messrs. Mobberley and Perry, Limited, referred to the part taken by the fire clay industries in the National Gas Exhibition. He pointed out that the fortunes of the Black Country were intimately associated with the matter, as the district possessed the finest seams of old mine fire-clay in the country. From this fire-clay was manufactured the refractory materials for the furnaces and retorts in which gas was made. Bearing in mind the fact that more than £140,000,000 of capital was invested in gas undertakings, and upwards of 300,000 men were employed in them, it would be seen that the Black Country had more than a passing interest in the future of gas.

Gas for Industrial Purposes in Yorkshire.—In the course of an article, on "Gas in Industrial Yorkshire," by a correspondent of the "Yorkshire Post" last Friday, the following remarks were made in regard to Bradford and Leeds: "In Bradford, whose industries are totally different from these of either Sheffield or Birmingham, there is no lack of evidence of the usefulness of gas for purposes other than lighting. A large volume of gas is used for heating conditioning pans or ovens in which samples of wool are dried and tested for moisture, or for heating an air-blast for a similar purpose. This is a new application of gas, and one of these ovens is on view at the National Gas Exhibition. A quantity of gas is used for singeing silk yarn before it is woven into material; gas is also found useful for a similar process applied to cotton or woollen goods, and for tentering, which is a form of drying. Again, gas finds extensive use for the internal heating of of drums in the calendering process. Owing to the fact that it is only on gas used in gas-engines that there is any special reduction in price in Leeds, it is difficult to ascertain to what extent gas is employed industrially. About 189 million cubic feet are used in gas-engines every year. A considerable quantity of gas is used in the clothing trade for such purposes as heating irons for pressing. Gas-fired muffle furnaces for annealing, &c., are used in several of the local engineering works, and further demonstrations of the possibilities of gas-fired furnaces are in evidence."

In view of the Bradford extension of boundaries scheme, a Committee of the Cleckheaton District Council, who have been empowered to act on the defensive against the scheme, have decided to take steps to acquire powers for the Cleckheaton Council to supply gas within the districts of Scholes and Oakenshaw, which are at present served by Bradford. There is a report of a proposed amalgamation of the various Spen Valley townships into one borough, to be known as Spenborough, and the matter is under the consideration of a Committee.

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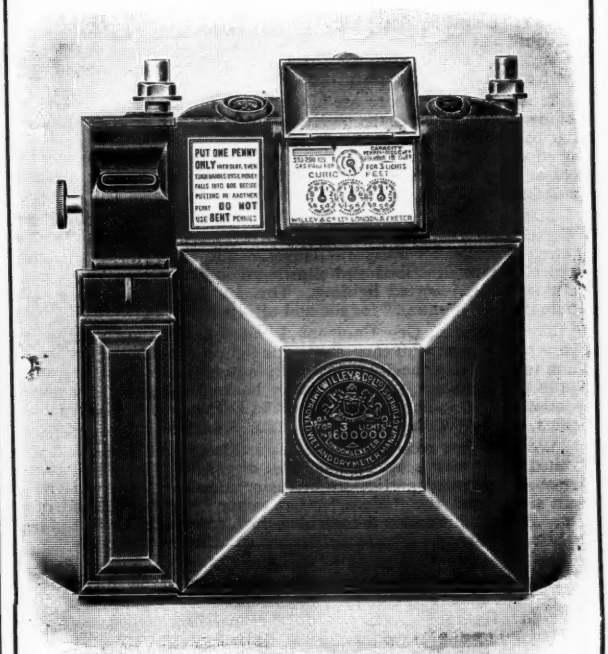

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In the "JOURNAL" for the 30th ult., it was recorded that a commencement had been made with the laying of a main to supply Kingskerswell with gas. It will be constructed with Mannesmann weldless steel spigot and faucet tubes with rigid joints.

The "Berkshire Chronicle" for last Friday contained articles on the progress of gas in Reading and the National Gas Exhibition. In the same number was an advertisement setting forth the features of the exhibition, and pointing out that a half day could be profitably spent there.

The Blaugas Company of Iowa, manufacturers of "bottled" gas for lighting and cooking, are about to establish large plant in Des Moines as a central production and distributing point for Iowa. An original investment of nearly $200,000 will be represented in the new institution.

The Titchfield Gas Company, as a result of obtaining parliamentary powers, are about to raise additional capital for an extension of mains, which are to be laid as far as Sarisbury and Hook, in which parishes the local authorities have hitherto refused their consent to the roads being disturbed.

The Wholesale Fittings Company, Limited, have sent us their catalogue of lighting specialities for the season 1913-14. These include the "Bonbac," "Natco," and other upright and inverted mantles, together with an endless variety of lamps, burners, Jena glassware, bead and other shades, and globes.

With reference to the announcement made in the "JOURNAL" a fortnight ago of the formation of the United Kingdom Employers' Defence Union, with a guarantee fund of £50,000,000, we learn from Mr. Mark H. Judge, of No. 7, Pall Mall, S.W. (Hon. Secretary *pro tem.*), that the prospectus and guarantee papers will be issued to employers of labour as soon as completed.

Mr. S. N. Brayshaw, of Hulme, Manchester, has sent us the new list (No. 48 F) of his specialities which has just been issued. It shows a variety of furnaces, pyrometers, cutters, &c. Following the particulars of these machines are useful tables for the conversion of thermometer scales, and for finding the equivalents of millimetres in metres and of fractions of an inch in decimals.

A recommendation has been submitted to the Ripon City Council for the appropriation of £630 from the profits of the Gas Department for the relief of the rates. The hope is, however, expressed that this procedure will not always be adopted, as gas is still dear in Ripon; and it is suggested that the Gas Department might reduce the price rather than hand over the surplus for rate relief.

It is stated that there are in use in Birmingham over 120,000 gas cooking-stoves; while in the past year alone more than 14,000 gas-fires have been fixed. The atmosphere of the city has considerably improved during the last decade—a condition of affairs to which the work of the smoke inspectors of the Corporation and the larger use of smokeless fuel have both contributed largely.

Messrs. Falk, Stadelmann, and Co., Limited, of Farringdon Road, E.C., forward a copy of a catalogue just published of "Veritas" public lighting requisites for upright and inverted burners. Among the many types of lamps described and illustrated is the improved "Ukay" pillar lamp for inverted lighting. This lamp was the subject of an article in the "JOURNAL" for the 2nd ult. (p. 608).

The Horstmann Gear Company, Limited, of Bath, are experiencing a very busy season with their automatic lighting appliances, for, in addition to supplying the Liverpool Corporation with controllers at the rate of 125 per week, they have lately booked orders for many large installations, including Burnley, Larkhall, Devonport, Huddersfield, Belfast, Derby, Wallasey, Matlock Bath, Brentford, &c.

We have just received from Messrs. Fletcher, Russell, and Co., Limited, their new season's pamphlet of gas-fires and radiators. It furnishes illustrated particulars of their "Borneo" and "Palermo" plain series, and the "Hero," "Grosvenor," "Mayfair," and other fires. Attention is called to their new fuel, for which they claim high radiating efficiency. The pamphlet has an artistic wrapper.

At the statutory meeting of the Humphrey Pump Company last Thursday, the Chairman (Mr. Emile Mond) stated the Company had orders in hand and in course of execution amounting to a very large sum. Mr. Humphrey, replying to a shareholder's inquiry, stated that the large installations of pumps at Chingford had always worked without difficulty, and were at the present time acting in an entirely satisfactory manner.

Readers requiring information in regard to the Bennis patent machine stoker, with pneumatic gear and self-cleaning compressed air furnace, will find it in a pamphlet which is being sent out by Messrs. Ed. Bennis and Co., Limited, of Little Hulton, Bolton. It is a new and revised edition of one previously issued, a large number of which were placed with those responsible for the conduct of leading boiler-houses. The stoker and its applications are fully described by the aid of illustrations and diagrams, and the results of tests of it against hand stoking are given.

Arrangements have been made for a visit of the members of the West Bromwich Tradesmen's Association to the Corporation Gas-Works on the 29th inst.; and the gathering, which is the first of its kind in the history of the undertaking, promises to be a great success. About 250 invitations have been sent out. The party will be conducted over the works by the Gas Engineer (Mr. Harold E. Copp). The Mayor (Mr. J. A. Kenrick) and the members of the Gas Committee will, it is expected, accompany the party; and the Chairman of the Committee (Mr. J. Brockhouse) will entertain them to afternoon tea.

The Wandsworth Borough Council have considered the provisions of the Wandsworth, Wimbledon, and Epsom District Gas Act, 1912, with reference to the laying of gas mains in the streets, and have authorized the Borough Engineer to notify to the Gas Company the depth and position in which such mains are to be laid—viz., that except in special cases the depth to be required under carriageways be not less than 2 ft. 6 in., and under footpaths not less than 2 feet from the surface. Where there are exceptional circumstances, the Borough Engineer has been authorized to settle the depths for the mains.

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WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

LADY DEMONSTRATOR. Rochdale Gas Department. Applications by Oct. 18.

LADY DEMONSTRATOR. Birkenhead Gas Undertaking. Applications by Oct. 31.

ANALYTICAL CHEMIST. Cardiff Gaslight Company. Applications by Oct. 29.

SUPERINTENDENT WATER-WORKS DEPARTMENT. Calcutta Corporation. Applications by Dec. 8.

STOREKEEPER. Walsall Gas Department.

ASSISTANT RENTAL CLERK. Smethwick Gas Department. Applications by Oct. 22.

Agency Wanted.

COAL AND PIPES. No. 5797.

Manufacturer Wanted.

PATENTEE. 10, Cranley Place, S.W.

Meeting.

IMPERIAL CONTINENTAL GAS ASSOCIATION. 21, Austen Friars, E.C. Nov. 4. 2.30 o'clock.

Plant, &c. (Second Hand), for Sale.

RETORTS AND MOUTHPIECES. Newcastle-on-Tyne Gas Company.

Stocks and Shares, Sales of.

BARBADOS GAS COMPANY. London Mart. Oct. 21.
CHRISTCHURCH GAS COMPANY. London Mart. Oct. 21.
COLONIAL GAS ASSOCIATION. London Mart. Oct. 28.
CREDITON GAS COMPANY. London Mart. Oct. 28.
DARTFORD GAS COMPANY. London Mart. Oct. 21.
ENFIELD GAS COMPANY. London Mart. Oct. 21.
LEA BRIDGE GAS COMPANY. London Mart. Oct. 28
REDDITCH GAS COMPANY. Grand Hotel, Birmingham. Oct 30.
ROMFORD GAS AND COKE COMPANY. London Mart. Nov. 4.
SAXMUNDHAM GAS COMPANY, LIMITED. London Mart. Oct. 28.

Stocks and Shares, Sales of—*continued.*

SOUTHGATE AND DISTRICT GAS COMPANY. London Mart. Nov. 4.
STANFORD-LE-HOPE GAS COMPANY. London Mart. Oct. 21.
SUTTON GAS COMPANY. London Mart. Oct. 21.
TENDRING HUNDRED WATER COMPANY. London Mart. Oct. 21.
UNITED DISTRICT GAS COMPANY. London Mart. Oct. 28.
UXBRIDGE GAS COMPANY. London Mart. Oct. 28.

TENDERS FOR

Fire Clay Goods.

SHEFFIELD GAS COMPANY. Tenders by Nov. 4.

Purifier Boxes.

SHEFFIELD GAS COMPANY. Tenders by Nov. 4.

GAS COMPANIES' STOCK AND SHARE LIST.

Lugubrious as was the tone of last week's review of the Stock Exchange, it would be easy to pitch this week's in an even higher pitched strain of lamentation. All markets have been most gloomy and despondent. Sellers were pressing securities on unwilling buyers; and, in result, prices melted away until every department showed an almost unbroken array of losses at the close. The causes of this continuous shrinkage are too complex for discussion in the "JOURNAL" columns. The opening on Monday was as quiet as ever—some declared more so—and all quarters of the House suffered from depression—prices drooping accordingly. Government issues were weak, though Consols did not move. Rails hung fire, awaiting labour developments. Foreign Exchanges crushed Transatlantics very flat with pressure to sell. Tuesday was dull and weak. Gilt-edged went in fear of more competing issues, and Consols fell ¼. Rails were oppressed by the same factors as on Monday. On Wednesday, after a rather promising opening, which lasted long enough to help prices up a bit, a sharp revulsion set in, mainly instigated by Continental sellers, and markets suffered sharply. Government issues were much depressed, and Consols fell further. Transatlantics were hard hit. Things went from bad to worse on Thursday, and depression intensified in all departments. Gilt-edged were very weak, and Consols fell ¼ for money and ⅜ for account. Rails fell, though the market remained calm. Others were affected by heavy selling abroad. Friday endeavoured to shake off the incubus of depression; and for a while things looked a little firmer. But a relapse on renewal of sales sent everything down lower than it had opened. Consols changed hands at 72½ for money and 72 11/16 for account, Rails were lower with rare exceptions; and the Foreign Market was heavy. On Saturday the tone was as gloomy as the weather. The attendance was small owing to Jewish absentees; and movements were slight and irregular. Consols closed unchanged at 72½ to 72¾—a fall of ¼ in the week. In the Money Market, there was a good demand and a sufficient supply to meet it. Discount rates hardened. Business in the Gas Market was well up to the mark attained last week in point of activity; and transactions were well distributed throughout the list. The market was not absolutely immune from the depressing influences raging around, and one or two lines gave way to a slight degree. In Gaslight and Coke issues, the ordinary was half-a-point easier, with transactions ranging from 101 to 102¼. In the secured issues, the maximum realized 74 and 75⅞, the preference from 94½ to 95½, and the debenture 72⅜ to 73⅜—a fall of ⅛. South Metropolitan also closed ½ lower, with transactions at 108½ to 109¾. In Commercials, the 4 per cent. fetched 105½ to 106½, the 3½ per cent. 102½, and the debenture from 71½ to 72⅝. Among the Suburban and Provincial group, Bournemouth preference changed hands at 13 3/16, British at 45 (a rise of ½), Brentford debenture at 94¼ and 94⅜, Southampton at 104¾, South Suburban at 116, and (on the local Exchange) Liverpool "A" at 206½, and ditto debenture at 97. In the Continental companies, Imperial made 165 to 166½, ditto debenture 84 and 84½, Union 80 to 82, ditto preference 124½, and European 18⅛. Among the undertakings of the remoter world, Hong Kong marked 17⅝, Monte Video 12 1/32, Melbourne 97, Oriental 125 and 126, Primitiva 6⅜, ditto preference 4 15/16 to 5 1/16, and San Paulo preference 11.

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 11	4†	Alliance & Dublin Ord.	58–63	..	6 7 0
374,000	,,	July 11	4	Do. 4 p.c. Deb.	80–83	..	4 16 5
280,000	5	April 11	7½	Bombay, Ltd.	6¼–6½	..	5 11 1
50,000	10	Aug. 28	15	Bourne- mouth Gas & Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	28¼–29¼	..	5 2 2
347,500	10	,,	7		14½–15¼	..	4 11 10
75,000	10	,,	6		13¼–13⅝	..	4 7 3
880,000	Stk.	Aug. 14	14	Brentford Consolidated	262–267	..	5 4 10
330,000	,,	,,	11	Do. New	198–203	..	5 8 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	111–113	..	4 8 6
206,250	,,	June 13	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
217,380	Stk.	Aug. 28	11	Brighton & Hove Orig.	201–206	..	5 6 10
244,200	,,	,,	8	Do. A Ord. Stk.	148–151	..	5 6 0
530,000	20	Sept. 26	12½	British	44½–45¼*	+½	5 9 11
120,000	Stk.	June 27	4	Do. 4 p.c. Deb. Stk.	87–89	..	4 9 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	89½–91½	..	4 7 5
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4–5	..	—
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	75–80	..	5 12 6
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	107–109	..	4 11 9
1,513,280	Stk.	Aug. 28	5/9/4	Commercial 4 p.c. Stk.	105–107	..	5 2 1
660,000	,,	,,	5½	Do. 3½ p.c. do.	102–104	..	5 2 6
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	71½–73½	..	4 1 8
800,000	Stk.	,,	4	Continental Union, Ltd.	80–83	..	4 16 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	124–126	..	5 11 1
492,270	Stk.	—	5	Derby Con. Stk.	123–124	..	4 0 8
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11
1,002,180	10	July 30	10	European, Ltd.	17½–18½	..	5 8 1
16,386,660	Stk.	Aug. 14	1/17/4	Gas- light and Coke } 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref.	100½–102½	–½	4 15 0
2,600,000	,,	,,	3½		74–77	..	4 10 11
4,062,235	,,	,,	4		94–96	..	4 3 4
4,674,850	,,	June 13	3	Do. 3 p.c. Con. Deb.	74½–74½	–½	4 0 6
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	87–89	..	5 12 4
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	April 25	11	Hongkong & China, Ltd.	17⅝–17⅞	..	6 3 11
131,000	Stk.	Sept. 11	7⅜	Ilford A and C	150–153	..	4 19 8
65,780	,,	,,	6⅛	Do. B	118–120	..	5 2 1
65,500	,,	June 27	4	Do. 4 p.c. Deb.	89–91	..	4 7 11
4,940,060	Stk.	May 16	9	Imperial Continental	163–168	..	5 7 2
1,235,000	Stk.	Aug. 14	8¼	Do. 3½ p.c. Deb. Red.	83½–85½	..	4 1 10
300,242	Stk.	Aug. 28	6½	Lea Bridge Ord. 5 p.c.	118–121	..	5 3 4
561,000	Stk.	,,	10	Liverpool United A	206–208	..	4 16 2
718,100	,,	,,	7	Do. B	148–150	+4	4 13 4
306,083	,,	June 27	4	Do. Deb. Stk.	96–98	..	4 1 8
63,480	Stk.	June 27	3	Maidstone 3 p.c. Deb.	66⅛–68½	..	4 7 7

Issue.	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
75,000	5	June 13	6	Malta & Mediterranean	4⅛–4⅞	..	6 3 1
250,000	100	Oct. 1	4½	Met. of Melbourne } 4½ p.c. Deb.	96–98*	..	4 11 10
541,920	20	May 30	4	Monte Video, Ltd.	12–12⅝	..	6 8 0
1,775,892	Stk.	July 10	4½	Newc'tle&G'tesh'd Con.	99½–100½	..	4 9 7
529,705	Stk.	June 27	3½	Do. 3½ p.c. Deb.	83¼–84½	..	4 2 10
55,940	10	Aug. 28	7/10,6	North Middlesex 7 p.c.	12⅛–13⅛	..	5 11 5
300,000	Stk.	May 16	8	Oriental, Ltd.	124–129	.	6 4 0
60,000	5	Sept. 26	10	Ottoman, Ltd.	8–8⅛*	..	5 17 8
60,000	50	Aug. 14	13	Portsea, Island B	122–125	..	5 6 1
100,000	50	,,	12	Do. C	119–122	..	4 18 4
249,980	5	May 16	8	Primitiva Ord.	6–6½	..	6 3 1
499,960	5	June 27	5	,, 5 p.c. Pref.	4 1/16–5 1/16	..	4 16 5
521,600	100	June 2	4	,, 4 p.c. Deb.	93–95	..	4 4 3
346,198	Stk.	June 27	4	River Plate 4 p.c. Deb.	90–92	..	4 7 0
275,000	5	Sept. 26	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11–11⅛*	..	5 4 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49–51	..	4 18 0
135,000	Stk.	Aug. 28	10	Sheffield A	222–224	+2	4 9 3
209,984	,,	,,	10	Do. B	222–224	+2	4 9 3
523,500	,,	,,	10	Do. C	220–223	+½	4 9 8
90,000	10	May 30	7½	South African	10–11	..	6 16 4
6,429,895	Stk.	Aug. 14	5/9/4	South Met., 4 p.c. Ord.	108½–110½	–½	4 18 11
1,895,445	,,	July 11	3	Do. 3 p.c. Deb.	73–75	..	4 0 0
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	157–159	..	5 6 11
952,795	Stk.	,,	6	S'th Suburb'n Ord. 5 p.c.	115–117	..	5 2 7
60,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
117,058	,,	June 27	5	Do. 5 p.c. Deb. Stk.	115–117	..	4 5 6
594,740	Stk.	May 16	5	Southampton Ord.	102–105	..	4 15 3
120,000	Stk.	Aug. 14	7⅜	Tottenham } A 5 p.c.	136–139	..	5 6 1
543,940	,,	,,	5⅜	and } B 3½ p.c.	114–116	..	5 1 3
149,470	,,	June 27	4	Edmonton } 4 p.c. Deb.	90–92	..	4 7 0
182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98	..	5 2 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	111–113	..	4 8 6
30,000	Stk.	Aug. 28	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	155–160	..	5 4 8
255,686	,,	,,	6¾	,, B 3½ p.c.	132–137	..	5 0 4
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110–115	..	5 2 0
362,000	,,	,,	6½	Wimbledon 5 p.c.	111–116	..	5 5 7
98,000	,,	,,	6⅝	Epsom 5 p.c.	115–120	..	5 10 5
88,416	,,	June 27	3	3 p.c. Deb. Stk.	68–70	..	4 5 9

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